THE NATION AND SCIENCE

BY HERBERT HOOVER

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And the more one observes the more clearly does he see that it is in the soil of pure science that are found the origins of all our modern industry and commerce. In fact, our civilization and our large populations are wholly builded upon our scientific discoveries. It is the increased productivity of man which has come from these discoveries that has defeated the prophesies of Malthus. He held that increasing population would constantly lower the standard of living amongst men until the pressure of subsistence upon population would limit its number by starvation. But since his day we have seen the paradox of the growth of population far beyond anything of which he ever dreamed, coupled with a constantly increasing standard of living. This result would be impossible but for the men of fundamental scientific research and discovery. In fact, there is for the future but one contestment in the race with the principle of Malthus, and that is in pure science. If we would have our country increase in its standards of living and at the same time accommodate itself to an increasing population at the rate of more than 15 millions each decade we must maintain the output of our pure science laboratories.

The wealth of the country has multiplied far faster than the funds we have given for these purposes. And the funds administered in the nation today for it are but a triviality compared to the vast resources that a single discovery places in our hands. We spend more on cosmetics than we do upon safeguarding this mainspring of our future progress.

Eighty per cent of the men devoted to pure science research with us are in our scores of universities and colleges. Our universities have doubled in the number of their students. Their pre-war endowments and income have been depreciated by the falling dollar. New resources have been given many of them, but not enough to handle their new burdens of teaching. All of this has led them to more and more curtailment and the suppression of expansion in pure science research in order that they might attend the immediate problem of education. Thus the four or five thousand men in the United States who had demonstrated their ability for research of this character are not applying themselves in this direction so much as they are applying themselves to the education of the youth. Teaching is a noble occupation but other men can teach and few men have that quality of mind which can successfully explore the unknown in nature.

Not only are our universities compelled to curtail the resources they should contribute in men and equipment for this patient groping for the sources of fundamental truth because of our educational pressures, but the sudden growth of industrial laboratories themselves and the larger salaries they offer have in themselves endangered pure science by drafting men from the universities. This is no complaint against our great industries and their fine vision of the application of science. It simply means we must strengthen the first line of industrial advancement—pure science research.

These men of pure science are the most precious assets of our country and their diversion to teaching and applied science reduces the productivity which they could and should give to the nation. It is no fault of their own, but it is the fault of the nation that it does not give to them and to the institutions where they labor a sufficient support.

There is no price that the world could not afford to pay these men who have the originality of mind to carry scientific thought in steps or in strides. They wish no price. They need but opportunity to live and to work. No one can estimate the value to the world of an investigator like Faraday or Pasteur or Millikan. The assets of our whole banking community today do not total the values which these men have added to the world's wealth.

Some scientific discoveries and inventions have in the past been the result of the genius struggling in poverty. But poverty does not clarify thought, nor furnish laboratory equipment. Discovery was easier when the continent was new. Discovery nowadays must be builded upon a vast background of scientific knowledge, of liberal equipment. It is stifled where there is lack of staff to do the routine and where valuable time must be devoted to tending the baby or peeling potatoes, or teaching your and my boys. The greatest discoveries of today and of the future will be the product of organized research free from the calamity of such distraction.

The day of the genius in the garret has passed, if it ever existed. The advance of science today is by the process of accretion. A host of men, great equipment, long patient scientific experiment to build up the structure of knowledge, not stone by stone but grain by grain, is now our only sure road of discovery and invention. We do have the genius in science; he is the most precious of all our citizens. We cannot invent him; we can, however, give him a chance to serve.

He that questioneth much shall learn much.

—Bacon.

THE ANTI-BERIBERI VITAMIN CONTENT OF SWEET POTATO LEAVES AND SHOOTS[1]

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WITH TWO PLATES

In 1922 the senior author found that sweet potato (*Ipomoea batatas*) shoots and leaves form an excellent source of vitamin B for rats. Albino rats which had been decreasing in weight owing to lack of vitamin B, on being given daily one gram of air-dried shoots and leaves of sweet potato, rapidly recovered and increased in weight. At present, as control source of vitamin B, we are using in our laboratory dry sweet potato leaves and shoots, instead of the expensive yeast vitamin. We find that one-half gram of this material given daily as supplement to an otherwise complete ration enables rats to grow normally.

In 1922 Sherman and Smith defined vitamin B as follows:

> The term vitamin B at present includes: (1) the antineuritic vitamin found by Eijkman in rice, Grijns in beans, Funk and others in yeast, and later found in a wide variety of animal and vegetable substances, the absence of which causes polyneuritis in fowls, beriberi in man and a similar pathological condition in other mammals; (2) a water-soluble growth-promoting substance found by Hopkins, Osborne and Mendel, and McCollum in milk and later found in wheat embryo, yeast and the various materials furnishing the antineuritic vitamin. Absence of this vitamin causes loss of appetite, cessation of growth and finally pathological symptoms resembling those of beriberi. Similarity in occurrence and many properties speak for the identity of the anti-neuritic and growth-promoting water-soluble vitamins.

A study of the published work on vitamin B, however, shows that the growth-promoting water-soluble and the antineuritic factor are not identical.

Pacini and Russel (1918) and Bierry (1919) found that various bacterial cultures contain water-soluble B. Eijkman, *et al* (1922) did not succeed in confirming these experiments in regard to the antineuritic factor.

Nelson, Fulmer, and Cessna (1921) cultivated baker's yeast in an artificial solution of NH_4Cl, $CaCl_2$, K_2HPO_4, $CaCO_3$ and cane sugar. This yeast when added to an otherwise complete ration (2 per cent), except for vitamin B, enabled white rats to recover in weight and to grow.

Eijkman, van Hoogenhuijze, and Derks (1922) cultivated yeast in a synthetic medium (NaCl, KH_2PO_4, $CaSO_4$, $MgSO_4$, $FeSO_4$, $MnCl_2$, $ZnCl_2$, NH_4Cl, dextrose $+H_2O$). This yeast did not prove effective in curing polyneuritic fowls.

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Levene and Muhlfeld (1923) tested three samples of baker's yeast (Nos. 2, 3, and 9) and one sample of brewer's yeast. In daily doses of 0.200 gram, all the samples enabled white rats to grow normally. In 0.100 gram doses, brewer's yeast and baker's yeast No. 3 were sufficient to maintain normal growth, whereas Nos. 2 and 9 in such doses gave less satisfactory results. Thus, the proportional difference between the best and the poorest samples was not greater than 2 to 1.

With pigeons they obtained the following results:

> Brewer's yeast protected pigeons from polyneuritis in doses of 0.500 gm. per day; baker's yeast No. 3 gave irregular results in doses of 0.200 gm. per day and protected completely in doses of 0.500 gm. per day. Baker's yeast No. 9 failed to protect in doses of 0.500 gm. and gave irregular results in doses of 1.0 gm. (of three pigeons, one lived 50 days and two remained in perfectly normal condition after 70 days). Baker's yeast No. 2 failed to protect pigeons from polyneuritis in doses at least four times as large as the protective dose of No. 3.

Hauge and Carrick (1926) using chicks as experimental animals found that yeast is poor in antineuritic substance but rich in the water-soluble growth-promoting substance; and that corn is relatively rich in the antineuritic substance, but poor in the growth-promoting substance.

In testing for the presence of vitamin B, two types of animals have been used—the rats and fowls. The effect on the weight of the rats and the development of polyneuritis in the fowls has been generally taken as the criterion for judging whether the food tested is poor or rich in vitamin B. Hence, generally speaking, the test for vitamin B in which rats are used as the experimental animals should be interpreted as test for the water-soluble growth-promoting factor, and the test in which fowls are used, as test for the antineuritic vitamin. As shown above, food rich in growth-promoting substance is not necessarily rich in the antineuritic factor.

Regarding the identity or non-identity of polyneuritis gallinarum and beriberi, Vedder and Clark (1912) may be quoted:

> It is apparent from this study that the symptomatology and pathology of polyneuritis gallinarum can not be regarded as identical with that of beriberi in man. We have never observed any oedema in fowls at all comparable to wet beriberi in man, and while there are undoubtedly slight changes in the heart of fowls suffering from polyneuritis, there is none of the hypertrophy which is such a characteristic finding in human beriberi. In spite of these facts, however, there is more similarity than difference between the two diseases.
>
> When we consider the etiology of the two diseases, the case is different. The experiments of Fraser and Stanton and of Strong and Crowell prove beyond the shadow of a doubt that beriberi in man is the result of a too nearly exclusive diet of polished rice, or of other foods lacking in the neuritis-preventing substance. It has been proved beyond question that polyneuritis of fowls is due to a similar diet. The cause of the two diseases is therefore the same. Therefore, the conclusion already published by Chamberlain and Vedder "that the two conditions are due to the same pathological process causing slightly different manifestations in diverse species" is abundantly justified. Since this is the case, it is evident that we may deduce some important facts concerning the relation between diet and beriberi from the above feeding experiments on fowls.

Shimazono (1925), a Japanese authority on the same subject, may also be quoted:

> Years ago I said that beriberi and polished rice disease are in a state of very close resemblance; I do not now hesitate to say with the foregoing observations on avitaminosis, that beriberi and vitamin B deficient disease are in a state of very close resemblance. This view has more weight, when one sees human avitaminosis. If we examined our cases of human avitaminosis at a clinic as outpatients, we should not hesitate to diagnose them as beriberi. But in comparison with the ordinary beriberi, anorexia is marked, and changes in circulatory organs are comparatively little.
>
> Thus the symptoms and pathological findings of beriberi and vitamin B deficient disease hitherto observed are not quite the same. The relation resembles that between Grave's disease and experimental hyperthyroidism, as is well known we find some differences between Grave's disease and experimental hyperthyroidism although they are in close resemblance. Experimental avitaminosis may be produced equally well in any season, while beriberi has marked seasonal differences. It is more prevalent in a warm than in a cold season. It is beyond doubt that the deficiency of vitamin B in diet has an important relation with the onset of beriberi. It requires further investigation as to whether or not other conditions are necessary for onset of beriberi. We do not attain yet to the conclusion held by many scientists abroad and Ohmori and others in Japan that beriberi is avitaminosis and that the two are one and the same. On the other hand, we can not exactly agree with McCarrison, Ogata, and others who believe that onset of beriberi requires some other causation besides lack of vitamin B. This point requires further study.
>
> We, however, recognize that diet insufficient in vitamin B induces disposition for beriberi or rather it is the principal cause of the development of beriberi and when polished rice forms the staple, with addition of even a considerable amount of animal and vegetable foods, such diet may have insufficiency of vitamin B. Consequently we recommend the avoidance of polished rice diet and the taking of half polished rice or mixture of rice and barley in equal amount.

The test for vitamin B in sweet potato reported by Santos in 1922 is essentially a test for the growth-promoting water-soluble B. Hence, the necessity for testing the antineuritic or antiberiberic factor.

EXPERIMENTAL

Materials

Seventeen cockerels were used in the experiment, six of which were furnished by the Poultry Division of the Department of Animal Husbandry, and eleven were taken from the flock belonging to Molawin Hall (Students' Mess.)

The feeds were washed polished rice, washed casein, salt mixture[2]. Gravel, charcoal, and filter paper were also offered to the birds. They had access to water at all times.

The birds were confined in wire cages, 90 cm.×90 cm.×80 cm. in size. These cages were so placed that they were exposed to some sunshine,

[2] The salt mixture prepared according to McCollum and Davis (1915) had the following composition:

Sodium chloride	5.00 gm.
Dipotassium phosphate	12.10 gm.
Primary calcium phosphate monohydrate	2.56 gm.
Calcium lactate	29.44 gm.
Iron citrate	1.00

either in the morning or afternoon. The floor of each cage was cleaned every day.

Methods

The technique followed was essentially as follows: The animals were given a diet known to be deficient in antineuritic vitamin. As soon as clear external symptoms of polyneuritis were observed, camote was given daily in addition to the basal food. The external symptoms noted in most of the animals were: leg weakness, ruffled feathers, bluish comb, peculiar gait, tendency to raise feet in the air, or high stepping gait, stumbling, then unable to sit up, lying upon its side, *then becomes prostrated.* Also wing drop, retractions of the head, unable to swallow normally, slow but deep respiration, loss of weight.

Studies of the nerves of the birds that showed external symptoms and died uncured showed degeneration. The autopsies were performed by Dr. A. K. Gomez of the Department of Bacteriology and Pathology of the College of Veterinary Science.

The basal diet consisted of washed polished rice. Casein and salt mixture were given to the animals some time during the progress of the experiments. Vedder (1912) showed that polyneuritis gallinarum results with an otherwise balanced diet provided said diet is deficient in antineuritic principle. Our results are in harmony with this observation.

Results

Owing to lack of facilities, we were not able to place all the birds under experiment at the same time. Cockerels No. 5, 7, 8, 13, 14 and 15 died from unknown cause before we could see signs of polyneuritis, hence were not treated with camote.

Cockerel No. 16 did not look healthy from the beginning and died the day it was given sweet potato leaves and shoots. These seven fowls were of no use for the test for the antineuritic property of camote. Results on fowls treated with sweet potato follow:

Cockerel No. 1 weighed 699 grams on May 15, 1926, when it was placed on polished rice diet. The weight gradually increased to 790 grams by June 5. From this date the bird gradually decreased in weight. By July 10 its weight was only 561 grams and it showed clear symptoms of polyneuritis. From July 12, 5 grams fresh sweet potato leaves and shoots were administered daily. On the improved diet, the fowl became livelier and the polyneuritic symptoms disappeared, but its weight did not materially increase. From August 17, one gram casein was also given daily. Still, there was no material improvement in weight. So from September 14 salt mixture (0.1 per cent of the weight of the rice) was added. From this time the weight increased rapidly. By October 30 the animal weighed 1055 grams. From this date sweet potato was eliminated and the animal subsisted on polished rice, casein, salt mixture, gravel and charcoal, and

filter paper. On this diet the cockerel gradually lost weight and developed polyneuritis. On December 7, it was unable to stand. Again, sweet potato was given. On December 11, the bird was lying on one side, and was unable to swallow food. An injection of camote extract was given. On the morning of December 14, the animal was found dead. Autopsy showed that the bird was suffering from other ailments besides polyneuritis.

Cockerel No. 2. This animal weighed 715 grams on May 15, 1926, when it was placed on a diet of polished rice. The weight first increased and then gradually decreased. On July 24 it weighed 610 grams and five days later showed marked symptoms of polyneuritis (fig. 1, pl. I). As it was unable to swallow food, extract corresponding to 5 grams of fresh sweet potato leaves and shoots was given by mouth with a pipette. The second day, July 31, the animal was in a worse condition, (fig. 2, pl. I), being unable to move and lying flat on one side, though still alive. We thought that it would die. Ten grams fresh sweet potato was forced into its mouth. The poor bird swallowed this ration with great difficulty. Another day passed and the bird was still alive. August 3 found the bird in the same dying condition. At about 11:00 a. m. of this day, 2 cc. of sweet potato extract corresponding to 10 grams of fresh sample was given by intramuscular injection and then 5 grams of fresh sweet potato was given by mouth. After this treatment was given, the senior author gave instructions that the animal was to be watched and as soon as it died it was to be placed in the ice box for autopsy the next morning. The next morning, however, the bird was found moving about able to pick up and eat rice. The administration of fresh sweet potato leaves, 5 grams daily, was continued. Three days later (August 6) (fig. 3, pl. II) the bird was able to stand and from August 9 it was able to walk normally. By August 17 the animal looked perfectly normal except that the weight had not increased. So from this day 2 grams casein were given daily in addition to sweet potato and polished rice. From September 14 the feed was further strengthened with salt mixture. On October 30 the weight had increased to 1045 grams, and the animal looked ready for the cockpit (fig. 4, pl. II). Then the administration of sweet potato was stopped and the cock made to subsist on a ration of rice, casein, and salt mixture—a diet that is deficient in antineuritic vitamin.

After 27 days on this deficient diet, the fowl's legs were observed to be weak and the animal was in kneeling position much of the time. So five grams of sweet potato were again administered daily. On November 30 the animal was found dead. Autopsy showed that it had pneumonia.

Cockerel No. 3. This bird weighed 955 grams on May 15, 1926, when it was placed on a diet of polished rice. Like Nos. 1 and 2, it first increased in weight and then decreased.

By August 4 the symptoms of polyneuritis were very marked, so the daily administration of 5 grams of fresh sweet potato was begun. Improvement in the appearance and movements of the animal soon followed, but

still there was little increase in weight. From September 14, salt mixture was added to the diet. By October 30 the weight had reached 1172 grams and no sign of polyneuritis was detected. The fowl's desire to fight was very apparent. From October 30, sweet potato was again excluded from the diet, leaving only polished rice and salt mixture. By November 23, leg weakness and change in the color of the comb were again observed. Three days later the symptoms of polyneuritis were very marked. The neck was stiff and the animal could not stand. So again, 5 grams fresh sweet potato were given daily. The day after the first sweet potato ration the bird was "talking", as if it were thanking us for the life-giving sweet potato. On the second day it was able to move about the cage; and on the third it was able to pick up its own food. On January 17, again sweet potato was withdrawn. On February 4 the bird's gait was noticed to be unsteady; and the next morning the animal could not stand. So sweet potato was again given. In the afternoon of the same day, the bird was crowing. From February 18 to the end of the experiment it ate alone.

Cockerel No. 4. This bird weighed 937 grams on May 15, when it was placed on polished rice diet. This bird first increased and then decreased in weight. By August 4 it was clearly down with polyneuritis; so the addition of 5 grams fresh sweet potato leaves and shoots daily was begun. At once, the animal began to improve in appearance; but the weight did not materially increase. From September 14, salt mixture was incorporated with the diet, and the weight gradually increased, until by December 7 the bird weighed 1012 grams and the animal looked very healthy. From this date, sweet potato was cut off, and for the second time the fowl was placed on an antineuritic deficient diet of polished rice and salt mixture. On January 25, 1927, the animal's legs seemed weak. Four days later, the gait was unsteady, and the feathers looked rough. Then, again, five grams of sweet potato were given daily. By February 12, great improvement in the physical condition of the animal had taken place. The legs appeared normal by March 5. On June 4 the weight was found to be 1393 grams and the bird was as healthy as the cocks in the cockpit.

Cockerel No. 6. This bird was placed on polished rice diet August 4, 1926. By August 31 it had polyneuritis. It was then given, by mouth, 2 cc. of uray extract (*Amaranthus viridis*) which corresponds to 10 grams of fresh uray shoots. On September 3, the bird was lying flat on one side and looked as though it were dying. So the uray extract was replaced with fresh sweet potato leaves and shoots. Four days later, the bird was very much improved in general condition though there was little change in weight. So from September 14 salt mixture was incorporated with the diet. By December 10 the weight had gradually increased and the animal appeared as healthy as ever. From this date sweet potato was withdrawn, leaving only polished rice and salt mixture. By February 8 the bird was again down with polyneuritis, so again, sweet potato was given as sup-

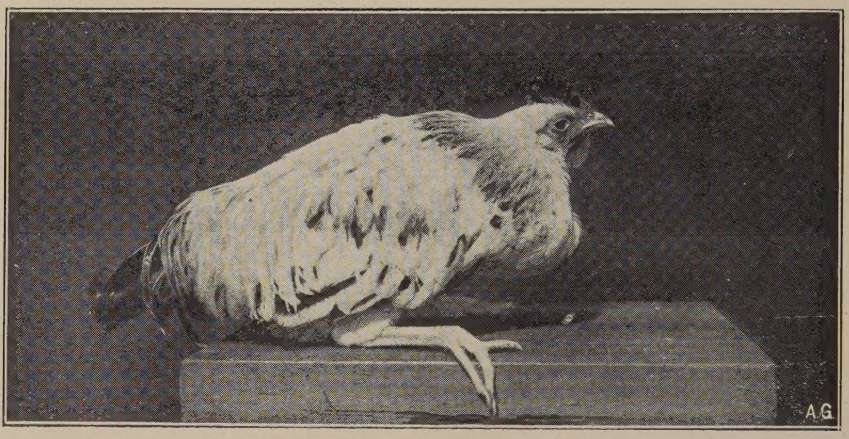

Fig. 1.—Cockerel No. 2, on July 29, 1926.

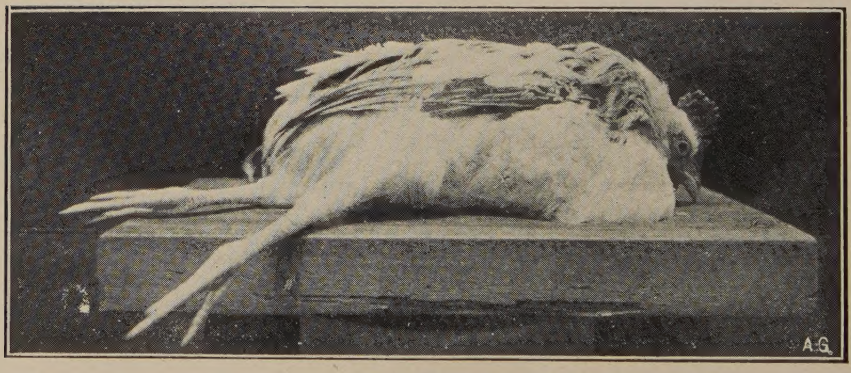

Fig. 2.—Cockerel No. 2, on July 31, 1926.

(*Photographs by the Photographic Division, College of Agriculture*)

PLATE I

Fig. 3.—Cockerel No. 2, on August 6, 1926.

Fig. 4.—Cockerel No. 2, in October, 1926.

(Photographs by the Photographic Division, College of Agriculture)

PLATE II

plement. By February 15 the animal had greatly improved and by June 4 it weighed 1375 grams.

Cockerel No. 9. From the beginning of experimental feeding on September 25 this animal subsisted on polished rice, salt mixture, plus 5 grams fresh uray and 1 gram casein daily. The casein was incorporated with the uray. By December 14 its legs were very weak and the bird lay down most of the time. There was, however, little improvement in weight, only from 558 to 635 grams. So from this date the uray was replaced with sweet potato. As soon as sweet potato was given, the bird became lively. By January 11, it was normal in appearance and movement and weighed 850 grams. So sweet potato was withdrawn and uray was again given as supplement. On uray as supplementary feed, the fowl again declined physically. By February 5 the bird again had polyneuritis and weighed only 703 grams. So uray was for the second time replaced with sweet potato. After 10 days on sweet potato as supplement the appearance of the bird was much improved. By June 4 it weighed 1100 grams and was normally healthy.

Cockerel No. 10. This animal weighed 915 grams on September 25, 1926, and was given the same treatment as cockerel No. 9; that is, daily ration of 5 grams fresh uray and one gram casein, salt mixture, and polished rice. The weight increased slowly until by November 27 it was 1132 grams. From this date to February 1, more or less constant weight was maintained. By February 5, the weight dropped to 947 grams; by February 8 to 885 grams and the animal was distinctly polyneuritic. So the uray was replaced with 5 grams fresh sweet potato leaves and shoots. After four days on sweet potato there was much improvement in the appearance of the animal, although the weight had decreased to 780 grams. Then the weight began to increase. By June 4 the cockerel weighed 1395 grams and was normally healthy.

Cockerel No. 12. Beginning with September 15 this bird subsisted on polished rice and salt mixture *ad libitum* plus one-half cc. tikitiki and one gram casein daily. On October 5 its left leg was injured. On November 30 the left eye was swollen. During this period, there was no material change in the original weight of 560 grams. By December 12, the bird looked very sick, so the tikitiki w s replaced with sweet potato. On the morning of December 13 the cockerel was found dead. Autopsy showed that it was suffering from other ailments besides polyneuritis.

Cockerel No. 17. This bird weighed 615 grams on December 18, 1926, when placed on a diet of polished rice, casein, salt mixture, gravel, charcoal, and filter paper. By January 25, 1927, it had polyneuritis, although there was only a little change in weight. Four days later, 5 grams of fresh sweet potato leaves and shoots were added as daily supplement; the animal soon appeared livelier. By February 12, it was normal in appearance. On June 4 the weight was found to be 900 grams.

Cockerel No. 18. This bird was given the same diet as No. 17. On December 18 it weighed 735 grams. By January 22 the weight had increased to 895 grams, which gradually decreased to 548 grams by February 22. At this time the bird had polyneuritis; so was given 5 grams fresh sweet potato leaves and shoots as daily supplement. On this diet, the fowl improved gradually and by June 4 it weighed 914 grams.

CONCLUSION

From the results here given, it is safe to conclude that sweet potato leaves and shoots form a good source of antineuritic vitamin, as well as the growth promoting water-soluble factor.

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THE GERMICIDAL PROPERTIES OF THE MIXTURE OF KEROSENE AND COCONUT OIL[1]

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WITH ONE CHART

INTRODUCTION

A germicide is indispensable in a farmer's home. The average farm home in the Philippines does not have any of the well known powerful disinfectants which are used on up-to-date farms. If these are available few know how to use them, and are afraid because of their supposedly highly poisonous effects. It is then of practical importance to study the disinfecting or germicidal properties of some of the most common materials with which the average farmer is well acquainted. In almost every farmer's home there is always kerosene and coconut oil, as the former is used for illumination and the latter for hair dressing and medicinal purposes and also for illumination. Almost ever since the introduction of kerosene into this country, it has been known that this oil, applied either in pure form or mixed with coconut oil, gives highly satisfactory results in the treatment of bruises, wounds, ulcers, mange, lousiness, and skin diseases; and also for disinfecting hands, instruments, and tools which have been used in treating sick animals. Kerosene alone or mixed in sufficient quantity with coconut oil has an appreciable insecticidal and a deodorizing property.

Many investigators have reported the insecticidal property of kerosene when applied in the form of an emulsion with soap. As a fungicide, Porquez (1926) observed that molds were not affected by any treatment with kerosene, no matter what the length of the period of soaking. In his experiments, however, he mixed water with the kerosene.

When kerosene is applied in its pure form on the sensitive skin and on fresh tissues it is decidedly irritating, markedly dehydrating and may produce blisters. Coconut oil has a softening, soothing, and protecting action on the skin, as it is an emolient. Therefore an ideal way of applying kerosene on the skin is to mix it with coconut oil which acts as a corrective.

As kerosene and coconut oil are well known and cheap, the use of a mixture of the two as a germicide should be known so that it could be used judiciously and effectively. The following experiments attempt to show

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the germicidal properties of mixtures of kerosene and coconut oil with a view to finding the proportion that has the highest germicidal power, that is, the mixture that requires the shortest period of exposure to kill the bacteria.

These experiments were performed in the Bacteriological Laboratory of the College of Veterinary Science with the advice and encouragement of Dr. A. K. Gomez, Head of the Department of Pathology and Bacteriology.

MATERIALS AND METHODS

The Cock Brand kerosene was used in this study. It was selected because it is the brand most widely used in the Islands. A sample of one liter was taken from a newly opened five-gallon can by pouring directly into a clean dry bottle which was then corked tightly.

The four samples of coconut oil *langis* (Tagalog) used were prepared in the laboratory by the common native process. The fresh meat of the nuts was grated fine, and its milk was extracted repeatedly with water by pressing the coconut meat between the hands. The emulsion thus prepared was strained through a double layer of cheese cloth and boiled down in a vessel until the oil was straw color. The oil was then decanted from the brown coagulum and filtered through a thin layer of cotton. The samples were kept in a wide-mouthed bottle loosely covered with paper. Before using, the samples were sterilized in the Arnold steam sterilizer for a period of one hour at 100° C. on each of four consecutive days.

Different mixtures of kerosene and coconut oil were made in plugged sterile test tubes, 7″×⅞″, by varying the percentage of kerosene by volume in coconut oil at room temperature of from 28.5° C. to 29° C. Sterile 10 cc pipettes graduated in tenths cubic centimeter were used in the measurements of the different volumes of the two oils. The mixture was poured back and forth from one test tube to another for at least ten times to thoroughly mix the oils.

Eberthella typhi Rawling, obtained through the courtesy of Dr. C. Panganiban of the Bureau of Science Serum Laboratory at Alabang, Rizal, was used as the test organism in the determination of the proportion of kerosene and coconut oil that has the highest germicidal power, and also with other experiments. It was cultivated on nutrient agar slant devoid of water of condensation.

As the materials under study are oils, the killing power of which against the test organism is far below that of phenol, neither the American Public Health Association standard methods of examining disinfectants (Park and others, 1918) nor the Rideal-Walker method could be closely followed. Hence, no attempt was made to determine the phenol coefficient of the mixture of kerosene and coconut oil. A method of preparing test objects for disinfection experiments given by Hill (1898) was followed at the begin-

ning of the work. As this method is really a modification of, and an improvement on, the well known method of Koch, and there was a possibility of employing it with oils, the writer tried this technic on eight trials. The results, however, were unsatisfactory as they varied greatly. Therefore, a modification of the standard technic was devised.

The seeding tube, 6″×⅝″, was provided with a piece of glass rod, 10 mm.×4 mm., to serve as bead. The tube was plugged with cotton and sterilized together with the bead in the hot air sterilizer for one hour at 160° C. Three cubic centimeters of oil or a mixture of kerosene and coconut oil were placed in the seeding tube, and about one milligram of the growth of a twenty-four hour old agar culture of *Eberthella typhi* Rawling was inoculated in the oil. By gently shaking the seeding tube to and fro for at least two minutes and holding the tube at an inclination of 60°, the bead broke the inoculum and spread the bacteria in the oil, thereby producing a uniform bacterial suspension and effecting a practically complete exposure of the individual cell to the action of the germicide. After a time interval of exposure, two three-mm. loopfuls of the oil bacterial suspension were transplanted to a tube of standard beef extract bouillon having a reaction of 1.5 per cent acid to phenolphathalein. The inoculated bouillon tubes were labelled properly and incubated at 37° C. for 48 hours.

EXPERIMENTS AND RESULTS

Experiment 1: On the determination as to whether or not the coconut oil acts as an adjuvant in its mixture with kerosene

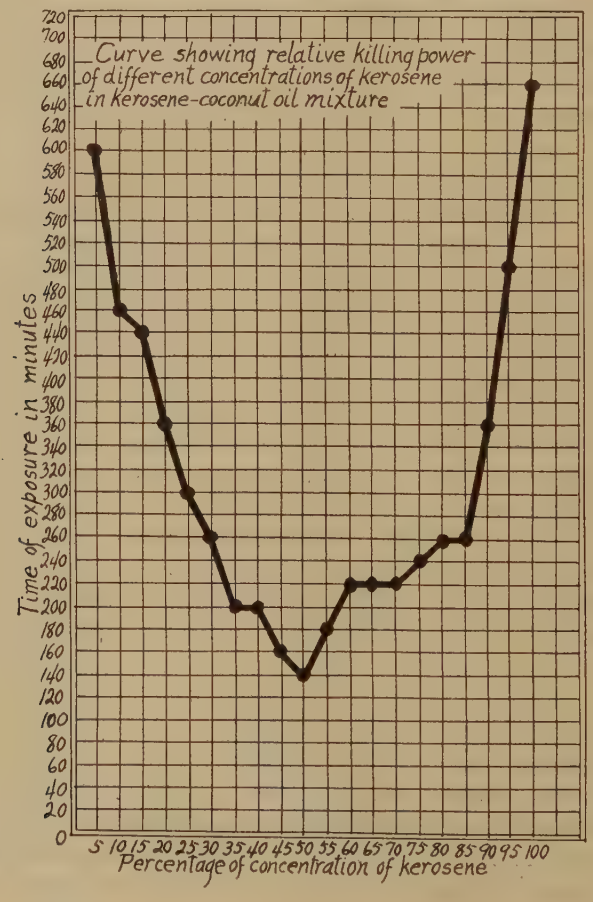
Three cubic centimeters of pure sterilized coconut oil, which was four months old, were placed in a seeding tube and inoculated with one milligram of the growth of a twenty-four hour old agar culture of *Eberthella typhi* Rawling. The seeding tube, described elswhere in this paper, was shaken gently for three minutes so as to have a uniform bacterial suspension in the oil. The temperature was that of the room, ranging from 28.5° C. to 29°C. during the months of August and September, 1927. After a time interval of one hour, two three-mm. loopfuls of the coconut oil bacterial suspension were transplanted to a tube of beef-extract bouillon. This procedure was repeated ten times under similar conditions.

The results are shown in table 1. The sign (—) indicates total destruction of the bacteria with no growth in the media, and the sign (+) indicates lack of destruction of the bacteria with growth in the media.

Experiment 2: On the relative germicidal power of the different concentrations of kerosene in coconut oil

A sample of coconut oil similar to that studied under experiment 1 was used in this experiment. After the different mixtures had been prepared, three cubic centimeters of each mixture were placed in a seeding tube. The same technic as in experiment 1 was followed. The percentages appearing

in the first column of table 2 indicate the amounts of kerosene in percentage by volume in the different mixtures at room temperature, and the 100 per cent indicates the undiluted kerosene. These results represent the averages obtained from three to five and sometimes nine trials for each mixture carried out under as uniform conditions as possible. The 50 per cent concentration, or the 1 to 1 mixture of kerosene and coconut oil, showed the highest germicidal power as, compared with the other mixtures, it required the shortest time to kill the test organism. The experiment with this mixture was repeated eleven times with the object of verifying its relatively high germicidal power. The results are shown in table 2 and are presented graphically in figure 1. The abscissa represents the time of exposure of the test organism at an interval of 20 minutes, and the ordinate represents the concentration or the percentage by volume of kerosene in the mixture with coconut oil. Each point plotted in the graph (figure 1) indicates the shortest time for a mixture to completely kill the test organism.


Curve showing relative killing power of different concentrations of kerosene in kerosene-coconut oil mixture
Time of exposure in minutes
720 700 680 660 640 620 600 580 560 540 520 500 480 460 440 420 400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Percentage of concentration of kerosene

Experiment 3: On the germicidal power of the 1 to 1 mixture of kerosene and coconut oil for various bacteria

As the mixture of kerosene and coconut oil is usually intended for external application, especially in the treatment of wounds, it was tested for its germicidal power on various pyogenic bacteria. Two species of the *Pasteurella* group were included in the test, just for comparison. These test organisms are maintained as stock cultures in our laboratory. They were subinoculated three days before being used.

As in experiment 2, the coconut oil used in this experiment was four months old. Equal parts of kerosene and coconut oil were mixed thoroughly at room temperature. The same technic as in experiment 2 was followed, with the exception of that with *Streptococcus hemolyticus* which was grown on blood agar slant and the transplants of its suspension in the mixture were made to tubes of serum water instead of that of beef-extract bouillon. The averages of the results are shown in table 3.

Experiment 4: On the effect of pure kerosene and the 1 to 1 mixture of kerosene and coconut oil upon the viability of anthrax spores

The same procedure was followed as in the previous experiments, except that the time interval was 24 hours. Two agar cultures of the Sisiman strain of *Bacillus anthracis*, one, 48 hours old and the other 13 months old, and also two agar cultures of the Los Baños strain of *Bacillus anthracis*, one, 48 hours old and the other 10 days old, were used in this experiment. These cultures were tested for the viability of the spores before used. The exposure of the spores to pure kerosene and to the 1 to 1 mixture was continued for 40 days. As the anthrax spores survived in pure kerosene and in 1 to 1 mixture of kerosene and coconut oil for a long period of exposure, it was necessary to determine whether they remained virulent by injecting their subcultures into susceptible animals. One cubic centimeter of the seventy-two hour old bouillon subculture, which was made from spores exposed to the action of kerosene and 1 to 1 mixture for different periods, was injected subcutaneously into four guinea pigs and two white rats. The results are shown in table 4.

Experiment 5: On the relation of the germicidal power of the 1 to 1 mixture to the age and acidity of coconut oil

Equal parts of kerosene and samples of coconut oil of different ages were thoroughly mixed, and three cubic centimeters of each mixture were placed in a seeding tube. The ages of the samples of coconut oil were 4 days, 30 days, 95 days, and 165 days. At these ages these samples had no odor indicating rancidity. All these samples were prepared in the laboratory and were kept under similar conditions. To determine the percentage of free fatty acids that might be present, each sample was titrated according to the method of Walker (1906) by dissolving five

grams of the sample of coconut oil in fifty cubic centimeters of neutral (to litmus) absolute alcohol and then titrating with N/10 sodium hydroxide. Phenolphthalein was used as an indicator. The average was taken from three titrations.

For the bacteriologic work the same technic as in the previous experiments was followed. The averages of the results are shown in table 5.

DISCUSSION OF RESULTS

Germicidal power of coconut oil

In all the ten trials, the four-month old coconut oil showed an appreciable germicidal action against *Eberthella typhi*. As shown in table 1, at room temperature of 28.5° to 29° C. the oil completely killed the test organism after an exposure of between 30 and 34 hours. This result clearly shows that coconut oil at a certain age is in itself a germicide and when mixed with kerosene it is not only a corrective but also a dependable adjuvant.

Lewkowitsch (1909) gives the following analysis of coconut oil:

Caproic acid	0.25 per cent
Caprylic acid	0.25 per cent
Capric acid	19.50 per cent
Lauric acid	40.00 per cent
Myristic acid	24.00 per cent
Palmitic acid	10.60 per cent
Oleic acid	5.40 per cent

A large number of samples, extending over a series of years, analyzed by Lewkowitsch, showed from 5 to 10 per cent of free fatty acids. Walker (1906) increased the acidity of a sample of pure coconut oil *langis* from 0.1 per cent to 8.63 per cent by adding 1 per cent of *latik* (Tagalog) (coagulum) and 1 per cent of water and then exposing the mixture to mold action in an incubator for one week. The same investigator pointed out that rancidity and free acid are not by any means synonymous.

Walker (1924) showed that capric acid, lauric acid, myristic acid and palmitic acid have an appreciable germicidal effect on the typhoid bacillus. It is then most probable that the action of the oil is largely due to the free fatty acids and in some degree to the difference in osmotic pressure between the bacterial cell protoplasm and the oil.

Relative killing power of the different concentrations of kerosene in coconut oil

As shown in table 2 and in the graph, the concentration of kerosene bears no relation to the germicidal power of the mixture. The killing power increases as the concentration increases from 5 to 50 per cent, but it decreases as the concentration increases from 50 to 100 per cent, that is, pure kerosene. It is evident that the 50 per cent concentration, or the 1 to 1 mixture, required the shortest period of time to kill completely the test

organism, in other words it has the highest germicidal power. It is very possible that the two oils at this proportion can exert to the greatest advantage their combined killing power against the bacteria. Pure kerosene requires 640 minutes to kill completely the typhoid bacillus, but its killing power increases as it is diluted from 100 to 50 per cent with coconut oil. This shows that kerosene has its highest germicidal activity when it is in 50 per cent concentration in coconut oil.

Germicidal effect of the 1 to 1 mixture of kerosene and coconut oil for various bacteria

The 1 to 1 mixture of kerosene and coconut oil has an appreciable germicidal effect on several pyogenic bacteria. As shown in table 3, it takes 160 minutes to completely kill *Streptococcus hemolyticus*, 200 minutes to kill *Staphylococcus pyogenes aureus*, 220 minutes to kill *Staphylococcus pyogenes albus*, 180 minutes to kill *Pseudomonas pyocyaneus*, 210 minutes to kill *Pasteurella aviseptica*, and 180 minutes to kill *Pasteurella suiseptica*. It is to be anticipated, however, that with increase in age of the coconut oil the killing strength of the mixture will naturally be increased.

However low the germicidal power of the mixture may be it can be relied upon to a certain extent as a germicide in the treatment of wounds or other microbian skin diseases. In the first place, the presence of coconut oil prevents rapid evaporation of the kerosene and being an emolient and a germicide it acts as a corrective as well as an adjuvant. In the second place, the mixture is neither strongly toxic nor irritating so that it can be applied repeatedly or continuously without fear of any deleterious effect on the patient.

Should it be intended to apply the mixture extensively or on the whole body, being an oil mixture, the species of the animals must be taken into consideration, especially animals that respire through the skin. The writer applied the mixture repeatedly for three days on one-half of the surface of the body of four guinea pigs and one rabbit in treating suppurating bruises and lacerated wounds, incident to fighting. The wounds healed in four days and no after effect was ever manifested by the animals.

In the treatment of wounds with this mixture it is recommended that no water or disinfectant should be used in cleaning the wounds. The proper way is to clean the wounds with a piece of cotton soaked in the mixture. Then apply the mixture as thick as possible. As the mixture is inflammable, the soiled pieces of cotton can be burned easily and this will aid in preventing the dissemination of an infectious skin disease.

Effect of pure kerosene and 1 to 1 mixture of kerosene and coconut oil on anthrax spores

The spores of *Bacillus anthracis* are not affected by either the pure kerosene or the 1 to 1 mixture of kerosene and coconut oil. The results

showed that the spores remained alive even after an exposure of 40 days, and their virulence as shown in table 4 is not by any means affected. The amounts of growth in the subcultures did not vary according to the different periods of exposure. This shows that the spores remained dormant in pure kerosene and in the 1 to 1 mixture of kerosene and coconut oil. The guinea pigs and white rats that were infected subcutaneously with the growth of the subculture of spores, which were either exposed to pure kerosene or to 1 to 1 mixture, died in from 36 to 72 hours.

Relation of the germicidal power of 1 to 1 mixture to the age and acidity of coconut oil

Table 5 shows that the acidity of the coconut oil varies with the age, and, in turn, the germicidal power of the mixture varies with the age and acidity of the coconut oil. The germicidal efficiency of kerosene is considered as constant. These results are not regarded as very conclusive because of the limited data on hand. Further experiments on this phase of the subject are in progress and will be carried on for a year or more as the results warrant. These results are included in this paper only to offer an explanation for the relation of the germicidal power of coconut oil to its age, and consequently its acidity, since it plays an important rôle as an adjuvant in its mixture with kerosene. However, taking the germicidal action of kerosene as constant, these results show that the acidity of coconut oil is an index of its germicidal efficiency.

SUMMARY OF CONCLUSIONS

1. Coconut oil, prepared by the process common in the Philippines, on standing for several months, has a germicidal effect on the typhoid bacillus and this germicidal activity increases with age. When coconut oil is mixed with kerosene it acts not only as a corrective but also as an adjuvant.

2. The mixture of equal volumes of kerosene and coconut oil, or the 1 to 1 mixture, has a higher germicidal power than other proportions of the two oils or than either one of them in pure form.

3. The 1 to 1 mixture of kerosene and coconut oil, which is several months old, has an appreciable bactericidal efficiency against certain pyogenic bacteria, as the *Streptococcus hemolyticus*, *Staphylococcus pyogenes aureus* and *albus*, and *Pseudomonas pyocyaneus*.

4. Both the pure kerosene and the 1 to 1 mixture of kerosene and coconut oil have no effect whatever on the spores of *Bacillus anthracis*, even after an exposure of forty days.

5. The mixture of kerosene and coconut oil should not be regarded as a general germicide. Its germicidal effect, however, on the most common pyogenic bacteria can be relied upon to a certain extent in the treatment of wounds and some microbian skin diseases and in minor operations. Kero-

sene, being an insecticide, the mixture should be of great value in the treatment of scabies and lousiness.

6. Since the mixture of kerosene and coconut oil can remain for a considerable length of time on the surface of objects and hands, its use as a germicide, despite its low germicidal efficiency, can be taken advantage of in the absence of standard powerful disinfectants.

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TABLE 1

Showing the germicidal power of cocor

TRIALS	TIME IN HOURS OF EXPOSURE OF EBERTHEL												
	2	4	6	8	10	12	14	16	18	20	22	24	26
1	+	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+	+	+
4	+	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+	+
6	+	+	+	+	+	+	+	+	+	+	+	+	+
7	+	+	+	+	+	+	+	+	+	+	+	+	+
8	+	+	+	+	+	+	+	+	+	+	+	+	+
9	+	+	+	+	+	+	+	+	+	+	+	+	+
10	+	+	+	+	+	+	+	+	+	+	+	+	+

TABLE 2

Showing the relative killing power of the different concentrations of

CON-CEN-TRA-TIONS	TIME IN MINUTES OF EXPOSURE OF EBERTHELLA																		
	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380
per cent																			
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
10	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
15	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
20	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—
25	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—
30	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—
35	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—
40	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—
45	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—
50	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—
55	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—
60	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—
65	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—
70	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—
75	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—
80	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—
85	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—
90	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—
95	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
100	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

ut oil when four months old

LA TYPHI. TEMPERATURE 28.5° TO 29°C.

28	30	32	34	36	38	40	42	44	46	48	Controls
+	—	+	—	—	—	—	—	—	—	—	—
+	—	—	+	+	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
+	—	—	—	—	—	—	—	—	—	—	—
+	+	—	—	—	—	—	—	—	—	—	—
+	+	+	—	—	—	—	—	—	—	—	—
+	+	+	—	—	—	—	—	—	—	—	—
+	+	—	—	—	—	—	—	—	—	—	—
+	+	+	+	—	—	—	—	—	—	—	—
+	+	—	—	—	—	—	—	—	—	—	—

kerosene in coconut oil. Age of coconut oil four months

TYPHI. TEMPERATURE 28.5° TO 29°C.																CONTROLS
400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	72 hr.
+	+	+	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—
+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
+	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
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—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—	—
+	+	+	+	+	+	+	+	+	+	+	+	+	—	—	—	—	—

TABLE 3

Showing the germicidal effect of 1 to 1 mixture of kerosene and c

TEST ORGANISMS	TIME IN MINUTES OF EXPOSURE. TEMPERATU																
	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	1
Str. hemolyticus..	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	
St. aureus.....	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
St. albus.....	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Ps. pyocyaneus..	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Past. aviseptica..	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Past. suiseptica...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	

TABLE 4

Showing the effect of treated anthrax spores on guinea p

CONCENTRATION OF KEROSENE	AGE OF CULTURE	STRAIN OF B. ANTHRACIS	PERIOD OF EXPOSURE DAYS	TEST ANIMALS	TIME OF INJECTION
per cent					
50	48 hours	Los Baños	12	guinea pig 1	Oct. 22/27 11:00 a. m
100	10 days	Los Baños	25	guinea pig 2	Oct. 24/27 1:30 p. m.
50	13 months	Sisiman	36	guinea pig 3	Oct. 24/27 1:30 p. m.
100	48 hours	Sisiman	12	guinea pig 4	Oct. 22/27 11:00 a. m
50	48 hours	Los Baños	12	white rat 1	Oct. 22/27 12:00 m.
100	48 hours	Sisiman	15	white rat 2	Oct. 22/27 12:00 m.

TABLE 5

Showing the relation of the germicidal power of 1 to 1 mixture of kerosene and coco

AGE OF COCONUT OIL	REACTION TO PHENOLPHTHALEIN	TIME OF EXPOSURE OF EBERTHELLA TYPHI. TEMPER																
		MINUTES																
		20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	6	7
days	*per cent acid*																	
4	0.27	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—
30	0.61	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	—	—
95	1.10	+	+	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—
165	1.31	+	+	+	+	+	—	—	—	—	—	—	—	—	—	—	—	—

onut oil for various bacteria

E 28.5° TO 29°C.											CONTROLS
200	210	220	230	240	250	260	270	280	290	300	48 hr.
—	—	—	—	—	—	—	—	—	—	—	—
+	—	—	—	—	—	—	—	—	—	—	—
+	+	+	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
+	+	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—

s and white rats

TIME OF DEATH	CONTROLS
Oct. 23/27 at night	living
Oct. 26/27 12:00 m.	living
Oct. 25/27 at night	living
Oct. 23/27 at night	living
Oct. 26/27 10:00 a. m.	living
Oct. 26/27 8:00 a. m.	living

nut oil to the age and acidity of coconut oil

ATURE 28.5° TO 29°C.												
HOURS												CONTROLS
8	9	10	11	12	13	14	15	16	18	19	20	
—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—

IS THERE A SOLUTION?[1]

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Of the Department of Rural Economics

The annual unwelcome downward trend of prices for tobacco since 1920 has brought much suffering to our tobacco farmers. The cause of this falling of prices is the practically dormant market for tobacco abroad coupled with the nearly constant or increasing production in the principal tobacco regions of the world. The demand for Philippine tobacco in the United States, our greatest market, has declined considerably during the last few years.

In the province of Cagayan, the weekly newspaper, *Verdad*, has repeatedly warned the *cosecheros* of this dangerous economic situation caused by the low prices of their tobacco. The farmers know this. They know that the price offered for their crop is very low; so low that the total returns they receive for their year's labor and trouble is not enough to cover even fifty per cent of the total expenses incurred in producing the product. The farmers are now feeling the depressing effect of this situation. The majority of them cannot pay the tuition fees for their children who are in school; they cannot even prepare their fields for the next year's crop for lack of money; and far worse, some do not have the money to buy the everyday necessities.

Is there a possible remedy for this discouraging situation? What are the possible cures for this "economic malady"? It is the purpose of this paper to point out the causes for this "economic illness" and to suggest a possible remedy. It should be kept in mind, however, that the writer will attempt only to suggest possible cures. He does not claim that the remedies will effect permanent cures, but he believes that if some of them will be followed they will help a great deal in bringing about a healthier condition for our poor tobacco farmers.

SOME CAUSES FOR THE ECONOMIC CONDITION OF OUR TOBACCO FARMERS

First, the causes for any sickness should be known before any prescription can be made. Let us consider then what has brought about this depressing economic condition among our tobacco growers. Some of these causes are:

1. Too much dependence on one kind of crop.
2. Lack of organization among the farmers, a condition which prevents their being strong enough to influence the fixing of prices for their crop.

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3. The buying companies in the province take advantage of the weakness of the unorganized tobacco farmers.

4. Neglect on the part of the growers to improve the quality of their product.

Now, how does each of these causes help bring about the "sickness"?

Too much dependence on one kind of crop. Our farmers in the tobacco region put so much dependence on tobacco that if they fail to sell their product they become financially crippled and helpless. This forces them in the clutches of unscrupulous money lenders, or usurers. Once they become debtors to these merciless individuals, they have a very hard time to pay their debts, for the rates of interest are exorbitant, the annual interest oftentimes amounting to more than the original money borrowed. For this reason it is not uncommon to find tobacco farmers who produce tobacco from year to year solely for their creditors.

Dependence on one kind of crop, especially upon a crop that cannot be utilized for food, is very dangerous. The tobacco buyers know that these farmers need rice and other necessities, and that they use the money they get for their tobacco crop to buy them, that unnaturally they take advantage of the situation and do not buy the tobacco until they know that the tobacco growers are in dire need of money, and will agree to the terms they offer them for their crop. Because tobacco is practically the only cash crop of these farmers, they are driven to the wall when no one offers to purchase their produce.

Lack of organization among the farmers. There is no union, no strength to enable the tobacco farmers to influence the fixing of prices for their crop. Each sells his own tobacco to the tobacco buying companies or to individual tobacco buyers in the province. In other words, there is a keen competition between these farmers in selling their product. They undersell each other.

Economists teach that one of the results of competition is that it brings about a uniform price for a commodity on the market, and that this price is influenced to a certain extent by the demand and supply. Knowing this price is helpful to the farmer because it shows him how much of any one commodity he should produce the next season. If the price offers him a wide margin of profit, he naturally endeavors to produce more of the commodity than when the price is such as to barely reimburse him for his expenses in producing it. But this advantage of knowing the price holds good only when the farmer knows how much he spends in producing the commodity. If he does not know his cost of production, how can he know whether he is making profits or not out of his produce when it is sold at a certain price?

Unfortunately, a large majority of the tobacco farmers do not know exactly how much it costs them to produce a unit of weight of tobacco. Consequently, they cannot tell in advance how much tobacco they should produce the next season, so each produces as much as he can. This may

bring about over-supply, which with the usual competition among themselves, means selling at a very low price—so low that the cost of production is not covered. This explains why the majority of our tobacco farmers lose from 30 to 40 per cent of the money they invest in the production of tobacco. If these farmers were organized, if they had a union among themselves, they would not undersell one another, thus one cause of low prices would be eliminated.

The companies buying tobacco take advantage of the unorganized farmers. These companies are very powerful. They have a wide knowledge of the condition of the demand and supply of tobacco on the world's markets. Consequently, they know exactly the price they should offer to the farmers; a price that might be advantageous to them. But these buyers know that these farmers make no effort to learn about market conditions, that they are wholly ignorant about such things. Hence, the buyers, being human, offer the farmers prices very much lower than they could well afford to give. Their agents bargain with the farmers and often wait until the time when they can no longer hold out. Thus, generally when prices of tobacco in Manila for Cagayan tobacco is, say, ₱16 a quintal, it is ₱8 to ₱12 or even less in Cagayan.

Because these buyers are well organized, they can shift the advantage of the bargaining to their side. For example: Before the opening of the buying season one of the leading companies quotes, say, ₱16 a quintal as the highest price it can afford to pay. The other companies learn of this through their agents, or *corredores*. In the buying season the buyers always offer a price ₱2 to ₱3 lower than the maximum set by the leading company. Buyers compete and the farmer not knowing the maximum price tries to bargain, putting one against the other. But as the farmer needs cash, in the end he sells for around ₱14 instead of ₱16. This will never be otherwise with one farmer, ignorant of what could be paid, trying to meet single-handed organized companies conversant with the world markets.

In almost all cases, except when dealing with the co-operative marketing association of Tuguegarao and its branches, the buying companies fix the prices paid the farmers for the tobacco. The ignorant unthinking farmers go on raising as much tobacco as they can, thereby lowering the quality and consequently the price of the article. And by indirectly causing this are the buyers not just as blind as the farmers?

Poor quality of product. A careful analysis of the conditions existing in the tobacco region of Cagayan Province will reveal that the farmers are partly to blame for their present depressed economic situation. They do not take pains to improve the quality of their tobacco. Some time ago, a representative of one of the largest tobacco buying companies in the Cagayan Valley stated in *Verdad* that these farmers could get better prices for their crop if they only would raise a good quality of tobacco and classify it according to the old method used during the Spanish Tobacco

Monopoly; that is, classifying the leaves into "hands" or bundles, each containing 100 leaves of nearly the same size and quality. The *casas*, or companies, would be willing to pay more for the tobacco arranged in this manner because they would be saved the trouble of reclassifying it in their warehouses where it is baled and made ready for shipment to Manila. But the farmers have not heeded this advice. They still carry on competing in the amount of leaves they turn out from a unit of area of land, not taking into consideration the greater monetary returns they would get from the same area if they improved the quality of product. These farmers are also very careless in curing the tobacco leaves. They cure them, in most cases, in any convenient place, sometimes in their houses, sometimes under them, or under the trees. There are very few who can afford to cure their tobacco under sheds built for this purpose. As a result of this undesirable practice the farmers get low prices for their product.

Of course, their excuse is that they get the same price for their tobacco regardless of quality. Leaves carefully cured sell for the same price as leaves carelessly cured. This means no wages for extra work. This is true, but they lose because buyers reject the poorest leaves which usually compose from fifteen to as high as fifty per cent of a farmer's total produce. But this difficulty could be remedied easily if the farmers would co-operate and try to produce as good a quality as possible. And if they can exert any influence in the fixing of prices through a mutual understanding among themselves, so much the better.

POSSIBLE SOLUTIONS

After learning the possible causes for any disease, the next thing is to determine the possible cures for that disease. In the foregoing paragraphs, I have tried to point out the possible causes for the depressing economic condition which the tobacco farmers are facing, and the way each of these might have brought about the "economic illness". Now, what prescriptions might bring about its cure? I shall try to give what seems to me might be possible cures. These are:

1. Organization among the farmers for co-operation.
2. Limitation of the number of tobacco plants raised by each farmer with a view to improving the quality of the product.
3. Diversification of crops.
4. Raising food crops, such as rice, corn, etc., instead of tobacco.

Organization among the farmers. The tobacco farmers could strengthen their position by organizing into co-operative associations. They would then be able to exert an influence in the fixing of prices for this commodity and stop the bad practice of underselling one another. There is a co-operative marketing association functioning in Tuguegarao with branches in Solana, and Peñablanca, but not all the tobacco farmers are members of this association. The majority are still fighting the movement. They

are still competing with this association instead of supporting it. If supported by all tobacco farmers in the region, the association should be able to bring about real results that would bring them relief. It could afford them credit facilities, improve the quality of production, bring about better prices for the crop, etc., and above all it would strengthen their voice when asking aid from the government.

Those good things which a co-operative association would bring to the tobacco farmers are not dreams. The co-operative marketing association of Tuguegarao has already shown to its members that these benefits are really obtained by members of this organization. In 1925–26 this association was able to accumulate ₱12,002.00 from commissions which it received from companies that bought its tobacco, a large sum of money that, without the association, would have gone to the pockets of the middlemen buying tobacco for these companies. The association used the fund to help its members out of financial difficulties by extending them loans at nominal rates of interest. The association, too, advanced money to pay taxes for several of its members who were not able to do so owing to delay in the sales of their tobacco or to the low prices received. Besides this visible help rendered, the members learn a great deal regarding the improvement in the methods of farming and marketing. The association has been able to obtain better prices for the tobacco of its members than was offered for the same quality belonging to non-members. This it was able to do despite the presence of many farmers in the municipality who are not members of the association and who tried to compete with it in selling their tobacco.

If the tobacco farmers want to improve their economic condition the best thing is to form co-operative marketing associations or support or be members of the one already functioning in Tuguegarao. In that way they can demand from the buyers the prices which they deserve as primary producers of the commodity, prices which they have heretofore not demanded owing to lack of information.

Limitation of the number of plants. To improve the quality of his product, each farmer should plant only as many tobacco plants as he can efficiently handle. The success of this remedy depends upon one of two things; namely, (1) the willingness of the farmers to carry it out by themselves, or (2) the enforcement of a law enacted to compel them to do this.

If the farmers were all members of a co-operative organization they could easily carry out the limitation. The members generally sign a contract with the organization one of the provisions of which should require each member to plant only the number of plants that can be taken care of by him, efficiently. The contract should also require that the produce from these plants should be cured, fermented, and classified under the rules and regulations formulated by the Board of Directors of the association. This is, I believe, the most effective way of applying this remedy.

If the farmers do not want to form co-operative associations, they can be made by law to limit the number of tobacco plants they cultivate. A law could be enacted requiring each farmer to plant, say, 6,000 plants. He should cure, ferment, and classify the produce from these plants in accordance with the rules and regulations that are now enforced by the Bureau of Internal Revenue. But in this law a minimum price should be fixed for each grade of tobacco so classified. This will insure the wages of the farmers for the extra effort and trouble in producing better quality of product.

Diversification of crops. The planting of two or more crops on the farm during the same season is called diversified farming. This practice is followed usually to avoid losses from failure or low price of one crop. The farmer who depends entirely on one crop must always be prepared to stand heavy losses; in years of plenty he must save for years of scarcity. Localities, too, that depend largely on a single product are subject to years of abundance and years of hard times.

The tobacco districts in the Cagayan Valley are no exceptions to this rule. In 1914-19 there was general prosperity on account of the high prices of tobacco. Since 1920, however, the low prices of tobacco have brought hard times. The price of this commodity is now so low that the average farmer is not able to sell his produce at a price to cover cost of production. And this year he cannot dispose of his crop at any price because there is practically no demand for it.

Now, the best remedy for this situation is for the farmer to plant other crops along with tobacco; resort to diversified farming. He should plant food crops, such as rice or corn with tobacco so that when he is not able to sell his tobacco he will at least have food; moreover, if the price of tobacco is very low he can store it and wait better prices. Having his own food supplies will also free him from getting into the clutches of unscrupulous money lenders.

The small area, only about one and one-half hectares on the average, handled by a tobacco farmer is a drawback to diversified farming. This area is too small to allow him to plant enough food crops along with tobacco for his family to depend upon when he is not able to sell his tobacco produce. But, even so, growing what he can will teach him that other crops are worth growing,—a knowledge which may be helpful to him when the time comes when he has no other course left but to entirely abandon the raising of tobacco.

Raising food crops instead of tobacco. Corn is the secondary crop in the tobacco region. Rice also grows very well on the tobacco land. If the production of tobacco no longer gives the farmer proper return after his best endeavor has been given it, why should he persist in raising this crop? Why should he spend the best years of his life in an unproductive enterprise? If you ask the average farmer this question, he will answer,

"I have been accustomed to raising tobacco. It was the occupation of my forefathers, my father. I simply cannot give it up, though I know that it does not pay".

But should the farmer not take a more common sense view of the situation? I believe that should he raise rice or corn it would pay him. He produces tobacco for the foreign market. He can not utilize it for food, if he cannot sell it. And if he is able to sell it the money he receives from the sale is hardly enough to pay for his food and other bare needs. If he raises rice or corn, he produces it for the local market. He finds ready sale for his surplus because it is a food crop for which there is always a steady demand. If he produces only enough for his consumption, he will not be in as a bad a position as when he depends entirely on tobacco because he will have food at least, the primary need of any human being.

SUMMARY

The causes for the depressing economic condition which the tobacco farmers are facing have been enumerated as:

1. Too much dependence on tobacco which renders the farmers helpless, financially crippled, when low prices accompanied by a small demand for this commodity occurs.

2. The farmers, being unorganized and ignorant of their cost of production, have no influence in the fixing of prices for their product; this is done by the buying companies. Because they undersell one another, the farmers are always paid prices much lower than what the buyers can really afford to pay.

3. The buyers bargain with the farmers because they know that they are ignorant of the condition of demand and supply of tobacco on the market. These buyers always succeed in shifting the advantage of the bargaining to their side because it is a case of a farmer ignorant of market conditions meeting single-handed a powerful business organization.

4. These farmers do not take pains in improving the quality of their product, consequently they do not get the prices commensurate with the labor and trouble they expend in producing the article. Besides a part of their total production, ranging from fifteen to as high as fifty per cent, is rejected by the buyers because of its being unfit for use.

But this discouraging situation is not by any means permanent in nature. These farmers could improve their economic condition by using common sense and applying certain remedies that would tend to alleviate their suffering. Different remedies have been suggested:

1. The farmers should organize into co-operative associations which might accord them credit facilities, improve their production, secure better prices and facilitate marketing of their crop, and strengthen their voice when asking aid from the government. They should become members of the

co-operative marketing association already functioning in Tuguegarao if they want to improve their economic condition, for if supported by all of them this association will surely bring to them relief.

2. If they do not see the advantages derived from membership in a co-operative organization, they could get better prices by improving the quality of their crop. If they cannot do this voluntarily, a law could be enacted that would require each of them to cultivate only, say, 6,000 plants to be cured and classified under the regulations now enforced by the Bureau of Internal Revenue. But, maximum prices should be fixed in this law for every grade of tobacco they produce, thus insuring wages for the extra effort they exert in turning out a good quality of product.

3. Failing in the above, these farmers can still improve their condition by resorting to diversified farming, planting food crops along with tobacco so that when they cannot sell this commodity they will at least have food while waiting for better prices. This practice will also teach them that it pays to raise other crops.

4. If these tobacco farmers find that growing tobacco no longer is a paying proposition they can stop producing this commodity and resort to planting food crops, crops that always are in a steady demand and have a ready market at home. Such a step would bring about healthier conditions for these poor farmers than taking chances on tobacco which requires a knowledge of world markets, instead of knowledge confined to the information they get from the buyers of their product.

I have presented these causes and possible remedies for the depressed economic situation which the tobacco farmers are facing. I do not claim that one particular remedy is the best. That I shall leave to the judgment of the farmers concerned. I personally believe, however, that any one of the remedies suggested can be applied in the tobacco regions, but as to which of them is the best depends upon the way the farmers look at the situation.

A STUDY OF (P. B. 119×C. A. C. 87) F_1 HYBRID AND OTHER SUGAR CANE SEEDLINGS AND THEIR PARENTS[1]

EUFRAIN M. MORALES

WITH SIX TEXT FIGURES

Among our Philippine crops, sugar cane is one that can be easily improved through the production of new varieties by hybridization. Once a new sugar cane variety is produced, it is easy to fix its characteristics, for the sugar cane plant is usually propagated by cuttings, especially by points.

There are various methods of improving the sugar cane and one of these methods is the production of seedling varieties. It is generally believed that plants grown from seeds exhibit a greater number of variations than those propagated asexually. A combination of desirable characters of two parent varieties may be obtained through cross-breeding. The hybrids generally show useful variations and the best ones may be selected and fixed by vegetative propagation. It is said that superior seedling varieties do not maintain their superiority for many generations as there is a tendency toward "senile degeneration". Superior seedling varieties, therefore, should be raised so as to have a continuous supply. By this means a high level of production can be maintained.

Review of past work with the parent varieties

Very little work has been done with C. A. C. 87 variety and especially with P. B. 119. Sumagit (1926) found that the diameter of the stalk at six months old and at about a year old were practically the same. In the width of the leaf, the typical width at the early stage was less than that at maturity. Blooming began at 309 days after sowing and stopped 30 days later. At maturity the most common color was purple but the typical color of the seedling was yellow. The average percentage of total solid computed was 14.47.

It was observed by Mercado (1926) that C. A. C. 87 even when planted in different plots and at different periods flowered at the same time; from November 4, 1925, to February 6, 1926. It took 11 days for the flower to send its whole arrow out, and it shed its pollen about 4 days after the appearance of the tip of the arrow. Most of the flowers opened 7 days after shooting and the seeds ripened in 22 days after the tip of the arrow had been exposed. On sunny days, the flowers opened earlier than on cloudy

[1] Thesis presented for graduation, 1927, from the College of Agriculture, with the degree of Bachelor of Agriculture, No. 261; Experiment Station contribution No. 508. Prepared in the Department of Agronomy under the direction of Dr. N. B. Mendiola.

days and remained open for seventeen and one-half minutes. Mature arrows gave a higher percentage of germination than those collected while immature. The variety gave the best germination in from 22 to 24 days from shooting to the cutting of the arrow.

Mendiola and Unite (1924) reported the following analyses of C. A. C. 87 made at different dates and in different years by the Chemistry Department:

	DATE OF ANALYSES		
	Nov. 2, 1922	Nov. 9, 1923	Dec. 3, 1923
Percentage of sucrose in cane	7.22	10.44	9.85
Gravity purity of first expressed juice	84.29	84.74	81.01
Quality ratio	1:15.6	1:10.6	1:11.8
Percentage of fiber in cane	12.15		

Mr. A. P. Goseco, formerly of the Pampanga Sugar Development Company, found that 17.62 tons of cane of C. A. C. 87 was needed to make one ton of sugar. The manager of the U. P. Sugar Mill reported the quality ratio of C. A. C. 87 to be 15.15 to 1. The quality ratio was calculated on standard central practice with 96 per cent sucrose extraction, 30 per cent purity of final molasses, and 96.5 per cent polarization of commercial sugar.

According to the analyses made by the U. P. Sugar Mill during the College milling season 1925–1926, the following was reported for the P. B. 119:

Tons cane ground	1.005
Brix of first mill juice	17.66
Polarization	14.80
Apparent purity	83.8
Tons cane per ton sugar	9.98

The quality ratio is calculated by assuming an extraction of 94.0; a Java ratio of 83.0; a Polarization of sugar, 96.5; a Purity of sugar, 97.5; and a Gravity Purity of Final molasses, 38.0

OBJECTS OF THE PRESENT WORK

The objects of this study were: (*a*) To study variability in characters of agronomical importance of supposedly hybrid seedling canes (P. B. 119 × C. A. C. 87) F_1; and (*b*) to study the possible importance of varieties involved as sources of useful hybrid seedling varieties.

This investigation was begun in April, 1926, and closed in January, 1927. The work was performed in the Nursery and Multiplication Field of the Plant Breeding Division, College of Agriculture, Los Baños, Laguna.

MATERIALS AND METHODS

Varieties used

The materials used in this study were the supposedly (P. B. 119× C. A. C. 87) F_1 hybrid seedlings, naturally-selfed seedlings of P. B. 119, and the parent plants, P. B. 119 and C. A. C. 87. The supposed hybrid (P. B. 119 × C. A. C. 87) F_1 and P. B. 119 naturally-selfed seedlings were grown from seeds collected in the arrowing season of 1925.

The C. A. C. 87 which was used as male parent is described by Mendiola and Unite (1924) as follows: "This is a medium sized cane, very long jointed, hard and erect. The stalk is reddish when young, but the red color gradually disappears as the plant becomes older. At maturity the stalk is yellow with some patches of slight red remaining. This variety was selected for its vigorous growth habit, its hardy qualities, resistance to the serious diseases found on the Philippine standard varieties, and its resistance to the bending effects of typhoons".

Fig. 1.—(P. B. 119 × C. A. C. 87)F_1 hybrid seedlings showing variability in the number of stalks. (1) Hybrid seedling No. 2381. (2) Hybrid seedling No. 2380. Selected. (All photographs for this paper taken by the Photographic Division, Department of Agronomy, College of Agriculture.)

The P. B. 119 cane is one of the six selected seedlings of Badila parentage produced in the 1920-1921 season. It is a heavy and soft cane. The color of the stalk when young is brownish green, turning dirty brownish green with burnt sienna when mature and exposed to sunlight. Its internodes are usually longer than those of Badila and crack occasionally; eyes are fairly well developed; and longitudinal linings are present all over the surface of the rind of the internode. It is self-trashing and produces an average of five stalks a stool. Although it is attacked by mosaic and leaf spots it has been selected for its exceptionally large size and fairly high sucrose content. It tassels very freely.

The asexual offspring of the 1925-1926 selected seedlings were also studied for their agronomical characters. These clons were known by their P. B. numbers. The Louisiana Striped selected seedlings were given P. B. 151 and P. B. 152; H-227 seedlings, P. B. 153 and P. B. 154; Badila

seedlings, P. B. 155, P. B. 156 and P. B. 157; and Cebu Purple, P. B. 158, P. B. 159 and P. B. 160.

Procedure of raising seedlings

The hybrid seedlings were grown from the seeds of P. B. 119 pollinated with C. A. C. 87. The method of cross-pollination used was as follows: During the blooming of the flowers, the arrows of C. A. C. 87 were shaken over the arrows of P. B. 119; also pollen collected from C. A. C. 87 plants and placed in a paper bag was dusted over the arrows of P. B. 119. The naturally-selfed seedlings were raised from P. B. 119 arrows which had not been artificially pollinated.

When the fuzz began to shatter, the seeds were collected and placed in paper bags for a few days to dry. They were germinated in seed boxes with a layer of soil of about ten cm. in depth. The soil used was ordinary field soil, sterilized in an open pan and then sieved. The fuzz was spread uniformly on the surface of the soil and kept moist. The germination boxes were covered with sheets of glass and kept exposed to sunlight. Within a week the plants began to appear.

The seedlings were from about 5 to 10 cm. tall when they were pricked into seed boxes where the soil was about 15 cm. deep. The pricked seedlings were transplanted to nursery plots and to the field when they were from 30 to 50 cm. high. They were planted 75 cm. apart in the row and the rows were one meter apart. Transplanting began in the middle of April and ended in the early part of May, 1926. The seedlings were watered daily for a month after transplanting. When the seedlings in the Nursery were about three months old, five grams of ammonium sulfate, $(NH_4)_2 SO_4$, were applied around each plant in a trench about 5 cm. deep. In this connection, it should be remarked that the seedlings grown in the Multiplication Field were not fertilized because this field had been planted to soybean which was plowed under, prior to planting the seedlings.

A total of 2000 seedlings was used in this study; 1500 of which were supposedly hybrids, (P. B. 119 × C. A. C. 87) F_1 and 500, P. B. 119, naturally-selfed seedlings. The seedlings were numbered with tin labels, the hybrids from 946 to 2446, and the P. B. 119 naturally-selfed seedlings, from 2447 to 2945. The seedlings labeled from No. 946 to No. 1690 were planted in the Plant Breeding Nursery and the others in the Multiplication Field.

Determination of variability among the seedling plants at the age of about one year

The variability in the following characters was observed on the seedlings about twelve months after sowing.

Color of stalks. The stalks were described as purple, rosy, and flesh colored.

Habit of growth. The plants were observed as to whether their stalks were erect, reclining, lodging, open or closed.

Average height of stalks. The height of a representative stalk of the millable stalks of each seedling was measured from the base up to the point where the cane top is severed.

Average diameter of stalks. The thickness of the middle of a typical millable stalk of each plant was measured with a Vernier caliper.

Average length of internodes. The internode at the middle of a representative stalk was measured.

Position of leaves. The seedlings were grouped as to whether their leaves were upright or bending.

Hairs on leaves. The presence or absence of hairs on the leaf sheaths was noted.

Millable and unmillable stalks. The number of millable and unmillable stalks of each seedling was noted.

Presence of diseases and pests. Diseases were observed on the leaves, stalk, and other parts of the plant.

Total weight of stalks. The weight was determined by weighing on a balance all millable stalks of each stool after the tops have been removed.

Fig. 2.—(P. B. 116 × C. A. C. 87)F_1 hybrid seedlings showing variability in habit of growth. (1) Hybrid seedling No. 2150, closed. (2) Hybrid seedling No. 2152, open.

Determination of total solids. The percentage of total solids was determined with a Bausch and Lomb Abbe refractometer. The method of determination was as follows: From the third internode of the main stalk of each stool, juice was extracted and placed between the upper and lower halves of the prism of the refractometer. After making a few adjustments of the refractometer, the refractive index was read on the graduated scale under the eyepiece. The temperature of each determination was recorded from the thermometer attached to the upper mount of the prisms. The control of temperature was accomplished by allowing cool water to circulate around the prisms of the refractometer, when the temperature prevailing during the time of determination rose above 29°C., and heated water when it fell below 27°C. With a conversion table, the per-

centage of total solids corresponding to each refractive index and temperature of the determination was computed.

Experiments and results

Though grown in two separate places, the seedlings under study were subjected to almost the same conditions, especially as to soil.

The culture was still in progress in 1926 when in the night of November 5 a typhoon of unusual intensity occurred, lasting nearly the whole night. All the plants were blown down, but only a few were entirely uprooted. The day after the typhoon, observations on the extent of the damage were made, and rehabilitation work was begun. Each plant was restored to its normal position by ridging and slightly pressing the soil around the base. A week after this treatment, the seedlings were observed to have recovered from the bending effects of the typhoon and when the observations on the different agronomical characters were performed, the plants were apparently in normal condition. These observations were made between December 18, 1926, and January 5, 1927.

The data on number of millable and unmillable stalks, color of stalks, habit of growth, position of leaves, presence or absence of hairs on leaves, prominence of buds, presence of diseases and pests, and the measurements of the average height, diameter, and length of internode of all millable stalks of each stool were gathered at the same time. The determination of total solids was performed by analyzing three hundred samples a day. At this rate, the analysis was completed in about a week. The determination of the tonnage of each seedling was made after the observations on all other agronomical characters were completed. The seedlings infected with Fiji disease were noted but not studied with regard to all other characters.

Parts of the results of this investigation are shown in tables 1 to 4, inclusive.

Table 1 is a summary of the field observations on the habit of growth, color of stalk, position of leaves, presence or absence of hairs on leaves, and prominence of buds, of (P. B. 119×C. A. C. 87) F_1 hybrid and P. B. 119 naturally-selfed seedlings.

Table 2 gives the extent of damage by the different diseases observed on the seedlings.

Table 3 shows the comparative agronomical characters of the parents, the supposed hybrid and P. B. 119 naturally-selfed seedlings.

Table 4 shows the comparative agronomical characters of the 1925–1926 F_1 selected seedlings in their sexual and first asexual generations.

TABLE 1

Summary of the field observations on the different characters of the seedlings

KIND OF SEEDLINGS	HABIT OF GROWTH					COLOR OF STALKS			POSITION OF LEAVES		HAIRS ON LEAVES		PROMINENCE OF BUDS		
	Open	Close	Erect	Reclining	Lodging	Purple	Rosy	Flesh	Upright	Bending	Present	Absent	Non-prominent	Prominent rounded	Prominent pointed
(P.B. 119×C.A.C. 87)..	160	1299	856	594	9	928	191	340	1016	443	1057	402	551	759	149
P.B. 119 naturally selfed	79	419	237	254	7	317	82	99	382	116	340	158	74	385	39

TABLE 3

Summary of the important agronomical characters of the parent plants, (P. B 119×C. A. C. 87)F_1 hybrid and P. B. 119 naturally selfed seedlings

VARIETY USED	TOTAL SOLIDS	WEIGHT OF MILLABLE STALKS OF EACH STOOL	AVERAGE HEIGHT OF STALKS OF EACH STOOL	AVERAGE DIAMETER OF STALK OF EACH STOOL	AVERAGE LENGTH OF INTERNODE OF STALK OF EACH STOOL	NUMBER OF MILLABLE STALKS OF EACH STOOL	NUMBER OF UNMILLABLE STALKS OF EACH STOOL
	per cent	*kgm.*	*cm.*	*cm.*	*cm.*		
P. B. 119.....	17.4361 ± .0729	2.9620 ± .0554	.8561 ± .0317	3.5672 ± .0696	7.6176 ± .0734	3.5588 ± .0619	2.9444 ± .0798
C. A. C. 87.....	11.4228 ± .0929	2.3071 ± .0945	1.4714 ± .0314	2.0857 ± .0284	15.6428 ± .0611	6.3213 ± .1169	10.2857 ± .6063
(P.B. 119×C.A.C. 87)F_1....	13.8146 ± .0178	3.2814 ± .0447	.8406 ± .0062	3.3848 ± .0091	8.5765 ± .0550	5.1789 ± .0510	2.1425 ± .0422
P. B. 119 naturally selfed....	14.2621 ± .0706	3.1166 ± .0645	1.0644 ± .0113	3.0552 ± .0119	10.4989 ± .7731	5.5080 ± .0912	2.0803 ± .0566

DISCUSSION OF RESULTS

There was a wide range of variation in the percentage of total solids in both the supposed (P. B. 119×C. A. C. 87) F_1 hybrid and P. B. 119 naturally-selfed seedlings; the total solids content, ranged from 2.91 per cent to 28.16 per cent, with a mean of 13.8146±0.0178 per cent. The P. B. 119 naturally-selfed seedlings showed a range from 2.91 per cent to 25.13 per cent, with a mean of 14.2621±0.0706 per cent. It will be observed from these figures that the hybrids had a wider class range with respect to the percentage of total solids than the naturally-selfed seedlings of P. B. 119. However, the standard deviation and the coefficient of variability for this character were higher in the P. B. 119 natural seedlings than in the hybrids.

Fig. 3.—(P. B. 119 × C. A. C. 87)F_1 hybrid seedlings showing variability in color. (1) Hybrid seedling No. 2371 similar to P. B. 119. (2) Hybrid seedling No. 2369 similar to C. A. C. 87. Selected.

The percentage of total solids in the hybrids was found to lie between the values exhibited by the parents. The hybrids had a higher percentage of total solids (mean 13.8146±0.0178 per cent) than the male parent (11.428±0.0929 per cent in table 3), but lower than the female parent (17.436±0.0729 per cent in table 3). It is interesting to note in this connection that invariably the seedlings of both groups, having only one or two short stalks in a stool, had an exceedingly high percentage of total solids.

The (P. B. 119×C. A. C. 87) F_1 hybrid seedlings had a wider range both in class value and in variability constants with regard to tonnage or weight of millable stalks than the naturally-selfed seedlings. The range of variability for the (P. B. 119×C. A. C. 87)F_1 hybrid seedlings was from 0.45 kilogram to 18.05 kilograms, and the P. B. 119 naturally-selfed seedlings, 0.45 kilogram to 14.85 kilograms. The variability constants (standard deviation and coefficient of variability) in the hybrid are higher than those in the P. B. 119 naturally-selfed seedlings. These were found to be 2.5267±0.0316 kilograms and 77.0006±1.4254 per cent for the hybrid and 2.1372±0.0456 kilograms and 68.5747±2.0414 per cent for the naturally-selfed seedlings. They had practically the same means, 3.2814±0.0447 kilograms for the hybrids and 3.1166±0.0645 kilograms for the naturally-selfed seedlings.

It may be remarked that such characters, as number of millable stalks, diameter of stalks, and height of stalks are contributive to the variation in weight of millable stalks.

Both classes of seedlings have practically the same height of millable stalks, the mode, or the typical height being 0.95 meter in both cases. The mean values are 0.8406±0.0062 meter for (P. B. 119×C. A. C. 87)F_1 hybrid and 1.0644±0.0113 meters for the P. B. 119 naturally-selfed seedlings. The height of millable stalks, as a character, however, had a greater coefficient of variability value in the hybrid than in the case of the naturally-selfed seedlings. These values were 42.0533±0.6125 per cent in the hybrid and 35.2405±0.8415 per cent in the naturally-selfed seedlings.

Fig. 4.—Naturally-selfed seedlings of P. B. 119 showing variability in number of stalks. (1) Seedling No. 2674. (2) Seedling No. 2643.

The hybrid seedlings again had a higher degree of variability with regard to diameter of stalk than the naturally-selfed seedlings. The mean diameter of the millable stalk of the hybrid was 3.3848±0.0091 cm. as compared with 3.0552±0.0119 cm. for the millable stalk of the P. B. 119 naturally-selfed seedlings. The variability constants were all greater in the hybrid than in the naturally-selfed seedlings. With regard to this character, it may be stated that the typical stalks of the hybrid seedlings measured not less than 3.3 cm. in diameter. The diameter of the stalk was found to be one of the agronomical characters, improvement of which over the male parent was partially attained by crossing. The male parent (C. A. C. 87) had a mean diameter of 2.0857±0.0284 cm. (table 3), while the female parent had 3.5672±0.0696 cm.

While the two groups of seedlings had the same range of variation in the average length of internodes of millable stalks, the hybrid seedlings exhibited a greater standard deviation and coefficient of variability than the naturally-selfed seedlings. The hybrid seedlings gave a standard deviation of 3.1071±0.0389 cm. and a coefficient of variability of 36.2280±0.5096 per cent. The naturally-selfed seedlings, on the other hand, had a standard deviation of 2.5581±0.5467 cm. and a coefficient of variability of 24.3654±0.5507 per cent. The mean length of the internode of the hybrid was 8.5765±0.0550 cm., of the naturally-selfed seedlings, 10.4989±0.7731

cm. It is interesting to note at this juncture that the hybrid seedlings had a greater diameter of stalk (3.3848±0.0091 cm.) and a shorter internode (8.5765±0.0550 cm.) than the male parent (C. A. C. 87) with stalk diameter of 2.0857±0.0284 cm. and internode of 15.6428±0.0611 cm. but exhibited a thinner stalk and longer internode than the female parent (P. B. 119) with stalk diameter of 3.5672±0.0696 cm. and internode of 7.6176±0.0734 cm. (See table 3.)

Upon examination of the data on the number of stalks both millable and unmillable, it was seen that the wider range of variation was again found to be in favor of the hybrids. The number of millable stalks in the hybrid ranged from 1.5 to 25.5 stalks and in the naturally-selfed seedlings, from 1.5 to 17.5 stalks; the unmillable stalks in the hybrid seedlings ranged from 1.5 to 11.5, and in the naturally-selfed seedlings from 1.5 to 7.5. The means for the number of both millable and unmillable stalks in both the hybrid and the naturally-selfed seedlings were practically the same. The hybrid seedlings were found to have a mean number of 5.1789±0.0510 millable stalks and 2.1425±0.0422 unmillable stalks. The naturally-selfed seedlings were found to have a mean number of 5.5080±0.0912 millable stalks and 2.0803±0.0566 unmillable stalks. Using the coefficient of variability as an index of variation it will be found that the characters in question were, in all cases, more variable in the hybrids than in the naturally-selfed seedlings.

It was seen that in both groups of seedlings there were more close stools than open ones. With regard to growth habit, the hybrids had more erect plants than reclining and lodging. In the naturally-selfed plants, however, there were more reclining plants than erect and lodging. An outstanding feature observed in these seedlings was the presence of a great number of erect or semi-erect plants among the hybrids. The occurrence of a minimum number of lodging plants was also an encouraging aspect in this study. In color of stalks, the purple plants predominated over the rosy and the flesh-colored ones. This seems to point out that a greater proportion of the hybrids had acquired the color of their male parent. In both kinds of seedlings, the plants with upright leaves were more abundant than those with bending leaves. There was a greater number of plants with hairy leaves than semi-smooth ones. With respect to the presence of hairs on the leaves, it may be mentioned that the female parent (P. B. 119) is more hairy than the male parent (C. A. C. 87). The prominence of buds in the majority of the seedlings of both classes was also a significant feature, as canes with prominent buds are a good class of planting material.

TABLE 2

Summary of the data on the diseases observed on the seedlings

SEEDLINGS USED	DISEASE FREE	FIJI	MOSAIC	LEAF SPOT			
				Very slightly	Slightly	Badly	Very badly
(P. B. 119 × C. A. C. 87)F_1..	5	5	46	30	715	566	61
P. B. 119 naturally selfed.....	0	1	12	2	400	71	13

Referring to table 2 it may be seen that leaf spot was more prevalent than the serious diseases, Fiji and mosaic. Five apparently absolutely disease-free plants were found in the hybrids, but none in the naturally-selfed seedlings. It should be recalled at this point that the hybrid seedlings were derived from a supposedly disease resistant male parent and a rather disease-susceptible female parent.

Table 3 is a summary of the important agronomical characters exhibited by both the parents and the hybrids. The figures listed are the means for the percentages of total solids, height of stalk, diameter of main stalk, length of internode, number of millable stalks and number of unmillable stalks. The data of the male parent, C. A. C. 87, and the female parent, P. B. 119, were computed from a smaller number of individuals than those of the hybrid and naturally-selfed seedlings. It is evident, from the figures in table 3, that the mean characteristic of the hybrid seedlings was in all cases located within the limits of the two parents. For instance, with regard to the percentage of total solids, the (P. B. 119×C. A. C. 87)F_1 hybrids had a mean value of 13.8146±0.0178 per cent while the male parent (C. A. C. 87) had 11.4228±0.0929 per cent and the female parent (P. B. 119) had 14.4361±0.0729 per cent. Likewise, in all other characters, such as the height of stalk, diameter of stalk, length of internode, number of millable stalks and number of unmillable stalks, the mean values for the hybrids lie between those of the parents. Except in the height of millable stalks, the hybrid seedlings exhibited the other agronomical characters in a more or less improved state.

Fig. 5.—(P. B. 119 × C. A. C. 87)F_1 hybrid seedling No. 2331 selected for its size.

TABLE 4

Comparative data from the 1925-1926 selected seedlings and their respective asexual offspring

SEEDLING NUMBER	PERCENTAGE OF TOTAL SOLIDS		WEIGHT OF MILLABLE STALKS		HEIGHT OF STALK OF EACH STOOL		DIAMETER OF STALK OF EACH STOOL		NUMBER OF MILLABLE STALKS IN EACH STOOL		NUMBER OF UNMILLABLE STALKS IN EACH STOOL	
	Sexual parent [a]	Asexual offspring [b]	Sexual parent	Asexual offspring	Sexual parent	Asexual offspring	Sexual parent	Asexual offspring	Sexual parent	Asexual offspring	Sexual parent	Asexual offspring
			kgm.	*kgm.*	*m.*	*m.*	*cm.*	*cm.*				
P.B. 151	21.036	12.320	3.2	4.80	2.25	1.61	2.45	3.24	3	7.60	4	3.60
P.B. 152	18.254	16.745	2.8	2.53	2.04	1.37	2.37	3.11	4	2.00	3	1.75
P.B. 153	20.354	16.126	3.3	3.25	2.50	1.70	2.08	2.78	5	6.16	5	7.00
P.B. 155	21.890	10.789	3.0	7.40	1.96	1.37	2.72	3.00	5	11.00	7	3.00
P.B. 156	21.470	12.846	2.6	4.01	1.36	1.74	2.62	3.78	5	3.83	3	2.50
P.B. 157	23.538	14.863	2.3	3.56	2.14	1.10	3.70	3.81	3	3.25	3	1.62
P.B. 158	20.958	16.304	2.2	3.65	1.71	1.05	2.66	3.16	3	4.86	1	1.63
P.B. 159	21.024	17.955	3.2	3.48	1.66	.95	2.40	3.46	6	4.80	2	2.20
P.B. 160	20.778	18.503	2.8	3.63	2.73	1.14	3.15	4.13	4	3.66	2	1.60

[a] Data for the sexual parents were compiled from Florida's thesis (1926).

[b] These data, which represent averages, were gathered by the writer.

Table 4 gives the comparative descriptions of the 1925–1926 selected seedlings as sexual parents and their respective 1926–1927 asexual offspring. The figures under the sexual parents are original determinations, when they were isolated during the 1925–1926 season. The data on the asexual offspring were obtained by the writer during the present experiment and represent averages for the characters studied. It was found that the asexual offspring had a relatively low percentage of total solids, as compared with that of their asexual parents. The same condition was observed also in the case of the height of the main stalk. However, the tonnage or the weight of millable stalks, the diameter of stalks, and the number of both millable and unmillable stalks, were greater in the offspring than in the parents—a condition which may explain the decrease in the percentage of total solids. For, as has been mentioned elsewhere in this paper, the cane plants with a very few stalks generally had high content of total solids. The marked increase in tonnage shown by the asexual offspring may be explained by the corresponding increase in the number and diameter of stalks.

In attempting to make the foregoing comparison, it must be borne in mind that the different agronomical characters were represented by one determination in the sexual parent and an average of a number of determinations on the asexual offspring. Moreover, no check was planted with the asexual offspring. For this reason, it was thought unwise to interpret the differences observed between the sexual parents and their asexual off-

spring with respect to these agronomical characters, in the light of probable error concept.

The selection of seedlings was made immediately after the observations on the different agronomical characters for each of the seedlings were completed. The selection was made by studying the mean values for the percentage of total solids, weight of stalks, height of stalks, diameter of stalks, length of internodes, number of millable and unmillable stalks and disease infestation of both the hybrid and naturally-selfed seedlings. In selecting the seedlings, special emphasis was given to the tonnage, height of stalks, number of stalks, and freedom from disease. All seedlings affected with mosaic were eliminated, but those slightly affected with leaf spots were retained. A certain allowance was given in the case of the percentage of total solids, that is, a seedling which had a percentage of total solids a little below the average, was selected if it excelled in other agronomical characters. Generally, the seedlings which had values, on or above the average of the different characters mentioned, were all selected. From among 1500 hybrid seedlings, 224 plants were isolated. Fifty-nine seedlings were selected from about 500 of the naturally-selfed plants of P. B. 119. All of these selected seedlings were turned over to the Division of Plant Breeding for subsequent observations.

Fig. 6.—(P. B. 119 × C. A. C. 87)F_1 hybrid seedling No. 2438 which is similar to P. B. 119 in color and characteristics of the rind, but resembles C. A. C. 87 in all other respects. Selected.

SUMMARY OF CONCLUSIONS

1. The hybrid seedlings involved in this study were first generation offspring of a cross between P. B. 119 as a female parent and C. A. C. 87, as a male parent. Hybridization was undertaken in an effort to combine in the hybrid plants such characters as thick stalk and high sucrose content from the female parent and long stalk and disease resistance from the male parent.

2. A high degree of variability in the percentage of total solids, weight of stalks, average height of stalks, average diameter of stalks, length of internodes, and number of millable and unmillable stalks, was observed among the hybrid and naturally-selfed seedlings. The range of variation

of these characters, was, in all instances, found wider in the hybrids than in the naturally-selfed seedlings.

3. Several characters of agronomical importance were apparently improved as a result of crossing; among these are tonnage, more erect stalks, number of stalks, and percentage of total solids. The P. B. 119 naturally-selfed seedlings gave a lower percentage of total solids than the parent, but excelled it in tonnage, height of stalks, length of internode, and number of millable stalks.

4. Some apparently disease-free plants appeared among the hybrids, but none among the naturally-selfed seedlings.

5. The asexual offspring of the 1925-1926 selected seedlings were found to be superior to the parent plants as to tonnage of cane, average diameter of stalks, and number of millable and unmillable stalks.

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GREAT FARMERS

The greatest Americans have been farmers and it is tragic for the school histories and rural school specialists to allow children to think of these men in other capacities with no reference to their leadership in agriculture.

Benjamin Franklin is glorified for many achievements but never a hint that he made a great contribution to successful farming. He was the pioneer in chemical fertilizing which transformed American gardening and later American farming. When Franklin represented the United States in France, which led the world in successful gardening, he was greatly interested in the fact that plaster was universally used by successful gardeners. Philadelphia was the center of progressive gardening in the New World and Franklin had a cargo of plaster brought across the Atlantic. But it did not sell promptly and so in front of the place where it was for sale he wrote on the lawn in plaster, *Plaster-of-Paris*. He meant simply to tell where it came from, but it has been called "Plaster of Paris" a hundred and twenty-five years and will be so called for another hundred and twenty-five years. Benjamin Franklin gave of his time, talent and money to promote the use of chemical fertilizers and every country boy and girl in America should appreciate it.

Hereford cattle are raised largely in every state in the Union. There are now several million of these white-faced cattle in the United States, but they are relatively a new feature of beef cattle in this country. Henry Clay was the greatest political orator America has known. He had the most intense following. He was the idol of many of the best people in the United States. Recently the city of Richmond, Indiana, erected a monument in honor of Henry Clay on the spot where he stood when he made a political speech there.

But Henry Clay's real monument is the white face steer which can be seen in every county in the United States. He was a great farmer. At Lexington, Kentucky, his farm which he called "Ashland," was the most famous farm in the New World eighty-five years ago, and the greatest attraction there were the Hereford cattle which he imported. The first white face cattle to cross the Atlantic were for "Ashland". Why not have country boys and girls feel a thrill of pride when they see and talk of Herefords?

Duroc Jerseys are now the most numerous swine in America. There are millions of these farm animals in the country but they are not here accidentally. They did not come spontaneously. They came to meet an emergency. Farmers have always been subject to live stock fanaticisms and it centered in swine eighty-five years ago. One group of farmers shouted

for black hogs and another for white hogs. The feeling was intense. Those who championed white hogs said that black attracted the sun and was liable to burn the skin. Then Daniel Webster, the greatest statesman-orator America has had, joined other peacemakers, compromisers, for he was the most famous political compromiser in the country, and imported red swine—neither black nor white—and today the Duroc Jerseys are the most numerous breed of swine in America.

Why not let country children have a bit of pride when they see Duroc Jerseys, knowing that Webster whose orations have been in school readers for seventy-five years, imported red swine from Spain?

Thomas Jefferson, the writer of the Declaration of Independence, the most famous president from Washington to Lincoln, was the most famous farmer except Washington until the civil war. Monticello, Charlotteville, Virginia, is Mount Vernon's only farm rival in historic interest. Jefferson made this residence and farm even more important in detailed perfection than Mount Vernon though it has not the location that Washington's residence has and it is not accessible to Washington and to patriotic tourists as Mount Vernon is. Monticello has been recently purchased by patriotic citizens and is to be a perpetual memorial to President Jefferson.

John Jay, the first justice of the United States Supreme Court, one of the leading American lawyers a century and a half ago, the writer of some of the greatest treaties between the United States and Great Britain, and the most famous governor New York state has had, devoted the last thirty years of his life to the promotion of scientific gardening in Westchester county, New York. He raised the best garden crops in the best way and introduced new varieties, of fruits, melons and vegetables and induced the produce dealers of New York to make a market for them. After thirty years in eminent statesmanship he spent thirty years in making farm life happier and more profitable.

It was George Washington, the father of his country, who was also the father of American farming and made Virginia, the mother of presidents, also the mother of farmers. A hundred and fifty years ago he established rotation of farm crops, was the first to breed better horses, better cattle and better sheep. Washington divided his estate on the Potomac into five farms with a masterful farmer in charge of each and no farm could raise any staple crop more than once in five years, no two farms could raise the same crop any year so that he had practically the same amount of each product every year and every farm rotated crops on a five-year schedule.

Washington was the first American to keep several high-quality stallions to improve his own stock and the stock of farms thereabouts. At the close of the Revolutionary war he bought from the government the young crippled mares and bred them to these high-grade stallions. He killed off the lambs that were not extra good and bred only the best sheep until he claimed that his sheep sheared five pounds of wool each more than any other

sheep. Perhaps Washington's greatest live stock service to America was the introduction of the mule industry. Pioneering in the southwest had a great boom and Washington himself invested in land in Missouri. He insisted that pioneering could not be profitable with oxen. They were too slow, nor with horses for they were too sensitive to weather conditions, to food and care. He said mules were indifferent to weather, care, and food. But mules were impossible without jacks and jacks were few, good jacks were wholly lacking in the United States. Spain and southern France had a monopoly of jacks, but Spain would allow none to be exported and France discouraged exportation. However, the king of Spain, an admirer of Washington, sent him the best young jack in his country and Lafayette sent him six likely jacks. Washington sent these jacks for service in the south and southwest, establishing an industry that now gives to America nine million mules, mostly of high grade.—A. E. WINSHIP. *Successful Farming* (Iowa).

"Never you mind the crowd, lad, nor fancy your life won't tell;
The work is done for all that, to him that doeth it well.
Fancy the world a hill, lad, look where the millions stop.
You'll find the crowds at the base, lad, but there's always room at the top.
Courage and faith and patience; there is space in the old world yet;
You stand a better chance, lad, the further along you get.
The road may be rough and rocky, but never despair nor drop;
Be sure your path leads upward, there's always room at the top."

Every piece of work which is not as good as you can make it, in which you have palmed off imperfect, meagerly thought, niggardly in execution, upon mankind, every hasty or slovenly performance should rise up against you in the court of your own heart and condemn you for a thief.—R. L. STEVENSON.

When tillage begins other arts follow. The farmers therefore are the founders of human civilization.—DANIEL WEBSTER.

EXTENSION DIVISION NOTES

The Need of Diversification in the Philippines

The Philippines though comprising 49 provinces may be divided into only a few crop regions, as the rice, the sugar, the abaca, the coconut, the tobacco, etc. In many provinces only one or two major crops and very little if any of the other crops are grown. There are provinces where rice alone is raised and others that produce only coconut or tobacco. In very few provinces could the crops be called sufficiently diversified for commercial purposes. As a result of this practice any abnormalities in the trend of prices of a Philippine crop vitally affects the regions in which that crop is raised. A sort of crisis often occurs in the regions.

For instance, if the price of sugar becomes abnormally low the people of Negros become distressed. If the price of tobacco falls it is the people of Isabela and Cagayan who suffer most. If the price of abaca moves downward the people of the abaca-growing regions are alarmed. Sometimes the government has to intervene to help the people, as recently was true in the rice region. The price of rice became lower than usual and the people at once demanded that the rice ban which has been in effect since 1919 be lifted. The pressure of this demand became so great that the Governor General declared the ban lifted for four months effective November 1, 1927. This was done in spite of opposition from some regions. These conditions of Philippine agriculture indicate that our crop industries are not yet very stable institutions.

We know that fluctuations in crop prices will occur because they are affected by changes in the world's supply and demand. We cannot control the price of any of our crops because all, except abaca, have foreign competitors and the prices are affected by the world markets. This is the natural course in the agricultural world and if we are to contribute to markets we must learn to compete. Our survival in competition is the index of the stability of our crop industries. In cases of economic disturbance which affects our country we must make our adjustments within. To safeguard our local economic interests at such times we must adopt preventive measures. One method of prevention is to practice diversification of crops to some degree. If this were done to a degree not detrimental to the main crop of the diversified system fluctuations in crop prices could be tided over until prices become normal.

Let us cite Batangas province as an example. The sole industry in this province is agriculture including several of our export crops; but it suffers little from fluctuations of crop prices. This is because diversified farming is practiced to a greater extent, probably, than in any other province

in the Islands. Also it is one of the very few provinces in which both live stock and farm crops seem to be raised in fair proportions.

The live stock industry in Batangas is perhaps one of the best if not the best representatives of an old development in the Islands. Here is produced the largest number of quality race horses. According to Mr. Valentin K. Lina's findings in the records of the Manila Jockey Club, "Batangas, Camarines provinces, Cebu, Cavite, Negros provinces, Misamis, Pampanga, and Bulacan, lead in supplying the Manila Jockey Club with race horses. Batangas registers about four times the number originating from Camarines provinces which rank second." They are nationally famous. Its work bullocks are no less renowned in local markets for their good conformation, endurance, strength, and hardiness. Hogs and chickens of Batangas, as commercially produced, are also of the best quality.

The province ranks first in coffee production, although the day of its glory when the exports of one town amounted to ₱4,000,000 annually is past. Batangas leads in the production of Mandarin, being the only province that produces this fruit in commercial quantities, and the quality is considered the best in the Islands. The province ranks third in cane sugar production, and has two modern sugar centrals. It is fast becoming a coconut region. Some towns have planted large areas of land comparable in size to plantations in towns of old coconut areas. The production of Bolbok, a coconut town of Batangas, is said to be almost equal that of Candelaria, a coconut district of Tayabas, and it is accepted that the production of Lipa, another coconut town, is more than the production of Alaminos, a coconut town of Laguna. The coconut plantations in the province are still on the increase, hundreds of hectares are being converted into coconut plantations every year. Besides these major crops the people raise tropical fruits of several kinds in fairly large quantities, and enough rice is produced for its own population. It also produces enough corn for the subsistence of its farm animals.

With this degree of diversification with a few major crop industries the agricultural status of Batangas seems to rest on a fairly stable basis. The people are never greatly worried by abrupt fluctuations in crop prices. Provinces the conditions of which warrant diversified farming should practice it as it is the safest way to insure a stable agriculture. If diversification can be practiced so as not to be detrimental to the major crop in so small a province as Batangas there is no reason why it cannot be practiced in other regions. Of recent years several provinces have been striving to follow the example of Batangas. Pangasinan, which formerly was a rice region, is now converting some of its rice fields to sugar cane, coconut, and mango plantations. A sugar central is to be erected in the province in the near future. Tarlac, another rice province, is increasing its sugar cane fields and a sugar central has recently been established in the province. We hope other provinces will follow suit.

One important reason why diversification should be practiced in the Philippines is that it can lessen the number of idle days of the Philippine farmer. It has been found that one of the causes of the poor financial condition of the Philippine farmers is that they are jobless so much of the time. Most of them practice the one crop system and after that crop is harvested they are idle as there is nothing more to do on the farm. If diversification were practiced they can find work almost throughout the year and their earning capacity will be materially increased. In some instances where the land cannot be cultivated in certain months of the year owing to dryness of the soil, idleness on the farm may be excusable. However, the raising of a few farm animals will help them a great deal. There are places in the Philippines where cultivation is possible throughout most of the whole year. In such places diversification can readily be practiced and idle days on the farm could be greatly reduced. In the present state of agricultural conditions in the Philippines there is a great need of diversification and it should be practiced where conditions permit.

Problems in Reviving the Coffee Industry of Lipa, Batangas

The revival of the coffee industry of Lipa, Batangas, is at present the hopeful speculation of many interested in coffee culture. That there is a strong tendency to replant the crop is quite true. The government is giving all the necessary aid to revive the industry. But in spite of the aid of the government and the enthusiasm of the people there are vital problems which make the revival not as fast as hoped. Very few, if any, wide and solid plantations are being started. Many are planting coffee, but they are planting it on a very limited scale and at a very slow rate.

The existing conditions in Lipa today explains why this is so. They are very different from when the coffee industry was developed years ago. In those times large *haciendas* were common in Lipa, and the land belonged to only a few families of the town. The farms, that is the coffee plantations, were all managed by administration. *Hacenderos* counted their servants by the hundreds. In those times labor was very cheap and the land owners had plenty of money so that they could easily afford to employ workers on wage basis. Since the downfall of the coffee industry in Lipa about 1890 the great majority of the large *haciendas* of Lipa have been continually broken up into small lots. The system of farm management has been changed from the administration system to the *kasama* system (share arrangement).

In starting coffee plantations, especially on a large scale, it is very necessary that it be managed by administration. Plenty of capital is needed and one must have other sources of income besides the land he is planting with coffee, because he will have no income from this for at least four years. In the first year he will plant nothing but the future shade trees of the coffee and prepare the seed. After planting the coffee at the

end of the first year he will have to wait for three or four years, depending upon the variety that he plants, before he gets any income from coffee. And during this time of waiting he will have to spend money for maintenance and upkeep. With these requirements it is very hard for a man with limited land and income to start a large plantation.

The conditions of the farmers in Lipa at present are such that it is impossible for them to open large plantations. Their farms are managed by the inexpensive *kasama* system. As we all know, the management of a farm under the *kasama* system involves the division of the produce between landlord and *kasama*. But land planted to coffee cannot be planted with another crop. This type of farming cannot be done under the *kasama* system. The *kasama* cannot wait for three or four years without income. And when the coffee bears fruit the sharing of the produce as under the *kasama* system cannot be made.

At present few people of Lipa can afford to run their farms by administration. The majority do not have sufficient land and capital to spare. So they plant coffee only in small patches such as they can spare every year. In many cases, purposely, no shade trees for coffee are planted. Lots that had been once a *kaingin* in which a second growth forest is growing are planted to coffee. In this way the farmers spend nothing for shade trees, thus saving a considerable sum of money and effort. This is of course not a very good method but it is decidedly the cheapest and one that they can easily afford. Such are the problems being met by the Lipeños in reviving their coffee industry.

Personal Inquiry from Guam on the College Copra Drier

Representatives of large plantation owners from the island of Guam came to the College Campus purposely to see for themselves how the Roxas-Henares copra drier is actually built. They had read the description in the College Circular No. 11. The gentlemen were Mr. Margarito Palting, Mr. José M. Torres and Mr. F. Iturzaeta. The first two are the sons of two wealthy coconut landowners in Guam, Attorney P. R. Palting and Mr. Francisco Calvo Torres, and the third is Mr. Torres' agent in Manila. These men were especially sent here to inspect the drier. They had read of the test of the efficiency of the drier made some time ago on the College Farm.

The visitors were welcomed by Acting Dean Gonzales and conducted to the place where the driers were erected and are being repaired from damages wrought by the typhoon last year. Dr. Vicente Aldaba, specialist in coconut, showed them part by part the construction of the drier and the manner in which it is operated. These men have been seeking a type of copra drier that would produce a superior quality of copra and at the same time a device small and simple and economical enough for small farmers to handle without difficulty. Their large plantations in Guam are divided

into rather small units, each unit being tended by a common farmer who does everything; planting, keeping, harvesting and making the nuts into copra. They are satisfied with their present system of a management and they do not want to change it. They desire to keep the farmer attached to his small farm unit. But they want to enable their tenants to produce a better quality of copra under the existing conditions by placing in their hands a suitable copra drier that can be run by them.

After a careful inspection of the machine, the visitors appeared satisfied that the College of Agriculture copra drier fully answers their purpose. Their idea is to introduce on their plantations for their tenants a drier like the smaller unit of the College Copra Driers shown them.

EXCHANGE NOTES

Gas ripened tomatoes were sold on the Minneapolis and St. Paul markets this season. These tomatoes were grown by local truck gardeners, picked when mature but before they began to turn, given the gas treatment three to five days and delivered to consumers. The process was tried repeatedly under laboratory methods before it was undertaken by farmers with crude equipment. Under both sets of conditions it was effective. . . .

"The gas ripened tomatoes are not distinguishable from those ripened in the field," said Mr. Stassen, "except that they have no green area around the stem. In the market no one could tell the difference, except perhaps for the uniform red color. I do not believe anybody could detect a difference in taste."

—*Capper's Farmer* (Kansas).

Male birds need not be kept, unless the breeding of chickens is desired. The fact that there is no male in the pen will have absolutely no effect on the number of eggs laid by the hens. A pen of six Black Orpington pullets at the Burnley Egg-laying Competition have just made an official record for winter egg production by laying 643 eggs in 122 days, ending 31st July, and no male birds are allowed with the pullets at the competition.

—*Journal of Agriculture* (Victoria).

The slow development of the primary industries of the State has for some time caused concern among those closely in touch with rural affairs. Australia is but a young country and the wealth of its soil is the first that should be exploited. Instead, however, we are confronted with very slight advances in the total quantity of primary products and an almost imperceptible increase in rural population. Unfortunately, even the young people brought up on the farms are being attracted away to city avenues

of employment, and the first effort to solve the problem must therefore be an endeavour to convince them that rural life is the pleasantest and the most profitable. As to the first of these conditions, ordinary social development is daily removing the disabilities that once attached to farm and station life, but the impression that the occupations of the country are as attractive financially as those of the city can only be achieved by inculcating sound methods of production.

With the view to making a beginning in this direction several organizations are combining in New South Wales to promote the formation of junior clubs for boys and girls in every district with the object of promoting competitions which will cultivate a liking for rural pursuits and arouse interest in their great possibilities. The many characters these competitions can take are obvious—some have already been conducted in this and other countries but their value in discreet hands cannot be doubted.

—*The Agricultural Gazette* (New South Wales).

The soy bean can now be grown successfully in any climate suitable to corn or cotton. The principal uses of the soy bean are for hay, pasture, silage, grain, oil and oil meal, and human food. With such a wide range of uses the production of the soy bean is no longer localized and its increasing importance is assured.

—*Cultivator* (California).

A butterfly "farm" is operated by Mrs. F. W. Casterline of Tipton, Iowa, on her screened porch. While she operates it primarily as a hobby she finds it a considerable source of income as well.

—*The Prairie Farmer* (Illinois).

During the year the Ministry of Finance (North Ireland) laid plans whereby the Ministry of Agriculture may grant loans to farmers for the purchase of bulls, agricultural machinery, erection of silos, minor land improvements, and erection of small structures. Short-time loans to replace livestock lost during the previous winter were also approved.

In general the plans provide for loans not to exceed 75 per cent of the cost, and fix a maximum and minimum that may be loaned, require the bull, machinery, or structure to be approved by the ministry, and require repayment in equal installments extending to 2 years for bulls, 3 years for machinery, 5 years for improvements, to 10 to 20 years for silos. Interest charges are fixed at from 5 to 5⅛ per cent. The regulations for loans for purchasing machinery, equipment, and bulls are set forth in detail.

—*Experiment Station Record* (U. S. Dept. Agric.).

Soy beans should be cut for hay soon after the seed pods have been formed and before the seeds have been fully developed, about the time the lower leaves begin to turn yellow and drop.

For seed soys should be allowed to become fully matured before harvesting. At this time the leaves will have largely dropped off. If they stand up well it is more satisfactory to cut and bind and shock them and let them stand in the shocks until dry enough to thresh. They may be cut with a mower and shocked until ready to thresh, but more of the seed will shatter and be lost and they will be harder to thresh.

In making hay of soys they should be allowed to become well wilted in the swath before raking and shocking, but should not be allowed to become dry enough to shatter off the leaves. The shocks will shed water better if put up when the hay is a little green.

—*Prairie Farmer* (Illinois).

Baked Bananas With Honey

6 bananas
2 tablespoons butter
2 tablespoons honey
2 tablespoons lemon juice

Remove skins and cut in halves lengthwise. Arrange in a shallow granite pan or platter. Spread the honey over the bananas, dot with butter and pour on the lemon juice. Bake 20 minutes in a slow oven, and baste occasionally with sauce.

—*Prairie Farmer* (Illinois).

COLLEGE AND ALUMNI NOTES

Mr. Tabat of the Bureau of Forestry and Mr. H. Atherton Lee of the Sugar Centrals Agency were recent visitors at the Division of Plant Breeding of the Agronomy Department. Mr. Tabat is in charge of the planting of Cinchona plants in Bukidnon. He spoke highly of the possibilities of quinine culture in Bukidnon. He looked over the seedlings of *Cinchona Ledgeriana* and *C. succirubra* being grown by the Department from seeds obtained personally by Doctor Mendiola from the Cinchona Experiment Station at Tjinjiroean, Java. Mr. Tabat is planning to take a course in rubber budding under Doctor Mendiola next College year. He secured from the division seeds of the cover crop, *Calopogonium muconoides* for trial in Bukidnon.

Mr. Lee visited the sugar cane breeding work being done by the department and received assurance of full co-operation by the Plant Breeding staff.

Prof. and Mrs. John Bentley, Jr., of Cornell University, were Campus guests for a few days recently. The Cornellians on the Campus entertained Professor and Mrs. Bentley at an All-Cornellian dinner at the residence of Doctor and Mrs. Tubangui. An evening of bridge at Doctor and Mrs. Mendiola's residence followed the dinner.

The Cornellians on the Campus are:
Forest School, P. Franco '22; College of Veterinary Science, A. K. Gomez '18, M. A. Tubangui '21; College of Agriculture, N. B. Mendiola '18, F. M. Fronda '20, A. Gordon '25, R. Moreno '25, F. T. Adriano '27, L. G. Gonzalez '27.